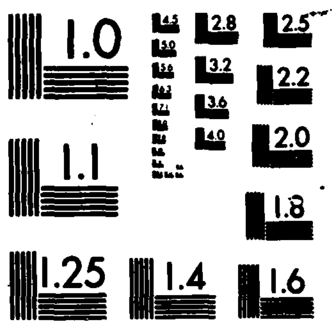
AD-A164 416 INSTALLATION RESTORATION PROGRAM PHASE II 1/3
CONFIRMATION/QUANTIFICATION STA..(U) WESTON (ROY F) INC
WEST CHESTER PA R JOHNSON ET AL. 20 FEB 85

UNCLASSIFIED F33615-80-D-4006 F/G 13/2 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

0

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION
STAGE 2

AD-A164 416

FOR

GRIFFISS FORCE BASE, NY 13340

PREPARED BY:

Roy F. Weston, Inc.
West Chester, Pennsylvania 19380

NOVEMBER, 1985

FINAL REPORT FOR PERIOD
JUNE 1984 TO NOVEMBER 1985

Approved for Public Release; distribution unlimited

PREPARED FOR

HEADQUARTERS STRATEGIC AIR COMMAND
COMMAND SURGEON'S OFFICE (HQ SAC/SGPB)
BIOENVIRONMENTAL ENGINEERING DIVISION
OFFUTT AIR FORCE BASE, NEBRASKA 68113

UNITED STATES AIR FORCE
OCCUPATIONAL & ENVIRONMENTAL HEALTH LABORATORY (USAF OEHL)
TECHNICAL SERVICES DIVISION (TS)
BROOKS AIR FORCE BASE, TEXAS 78235-5501

86 2 13 064

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION
STAGE 2

Accession For	
NTIS GRA&I	X
DTIC TAB	☐
Unannounced	☐
Justification	
By	
Distribution/	
Availability Codes	

Dist	Avail and/or Special	
A-1	23	

FINAL REPORT

FOR

GRIFFISS AIR FORCE BASE, NY 13340

STRATEGIC AIR COMMAND
OFFUTT AIR FORCE BASE, NE 63113

NOVEMBER, 1985

PREPARED BY:

ROY F. WESTON, INC.
WEST CHESTER, PENNSYLVANIA 19380

USAF - CONTRACT: F33615-80-D-4006 Delivery Order: 41

Contractor Contract: FY 7624-84-01667

COL R. C. WOOTEN

TECHNICAL SERVICES DIVISION (TS)

UNITED STATES AIR FORCE
OCCUPATIONAL & ENVIRONMENTAL HEALTH LABORATORY (USAF OEHL)
BROOKS AIR FORCE BASE, TEXAS 78235-5501

DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE

AD-A164 416

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS N/A
2a. SECURITY CLASSIFICATION AUTHORITY N/A	3. DISTRIBUTION/AVAILABILITY OF REPORT Distribution is unlimited
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE N/A	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) N/A	5. MONITORING ORGANIZATION REPORT NUMBER(S) N/A
6a. NAME OF PERFORMING ORGANIZATION ROY F. WESTON, INC. 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION USAF OEHL/TS
6c. ADDRESS (City, State and ZIP Code) West Chester, PA 19380	7b. ADDRESS (City, State and ZIP Code) Brooks AFB, TX 78235-5501
8a. NAME OF FUNDING/SPONSORING ORGANIZATION USAF OEHL/TS 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER F33615-80-D-4006
8c. ADDRESS (City, State and ZIP Code) Brooks AFB, TX 78235-5501	10. SOURCE OF FUNDING NOS. PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT NO.
11. TITLE (Include Security Classification) IRP Phase 2 Stage 2 - Final Report for Griffiss AFB, NY	

12. PERSONAL AUTHOR(S)
Richard Johnson, Frederick Bopp III, Deborah Jones

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Yr., Mo., Day)	15. PAGE COUNT
Final	FROM 7/84 TO 9/84	20 February 1985	

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB. GR.	Installation Restoration Program Ground-Water Contamination Griffiss AFB

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

A ground-water and soil contamination study has been performed at Griffiss AFB, Rome, New York. The field investigation was conducted from July through September 1984. Sites investigated included two fuel spill areas (Building 210 and Tank Farms 1 and 3), two battery acid disposal pits (Buildings 101 and 222) and Landfill 7. The work scope included 42 soil borings, monitor wells, the analysis of sludge/soil samples for metals and analyses of ground water samples for oil and grease, TOC, metals and volatile organic compounds. Limited environmental impact was observed from the Tank Farm and Landfill.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS ☐	21. ABSTRACT SECURITY CLASSIFICATION
22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE NUMBER (Include Area Code) / 22c. OFFICE SYMBOL

NOTICE

This report has been prepared for the United States Air Force by Roy F. Weston, Inc. for the purpose of aiding in the implementation of the Air Force Installation Restoration Program. It is not an endorsement of any product. The views expressed herein are those of the contractor and do not necessarily reflect the views of the publishing agency, the United States Air Force, nor the Department of Defense.

Copies of this report may be purchased from:

National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

Federal Government agencies and their contractors registered with Defense Technical Information Center should direct requests for copies of this report to:

Defense Technical Information Center
Cameron Station
Alexandria, Virginia 22314

WESTON

PREFACE

The purpose of the Report is to document the accomplishment of the Phase II Stage 2, Problem Confirmation Study of the United States Air Force Installation Restoration Program (IRP) at Griffiss Air Force Base, Rome, New York. This work was conducted by Roy F. Weston, Inc. under Contract No. F33615-80-D-4006, Task Order 0041.

Mr. Peter J. Marks is Program Manager for this Contract. Mr. Frederick Bopp III, Ph.D. managed this Task Order. Laboratory analyses were accomplished at WESTON's Laboratory in Lionville, Pennsylvania, under the supervision of James S. Smith. Roy F. Weston, Inc. wishes to acknowledge Major John Joyce, Base Bioenvironmental Officer and Bruce Mero, Base Civil Engineering Environmental Engineer for their assistance during the conduct of the project.

This work was accomplished during the period 25 June 1984 through 11 October 1984. Col. R. C. Wooten, USAF, BSC, Technical Services Division, USAF Occupational and Environmental Health Laboratory (USAF OEHL/TS) was the Technical Monitor.

WESTON

TABLE OF CONTENTS

TABLE OF CONTENTS (cont.)

TABLE OF CONTENTS (cont.)

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES (cont.)

APPENDICES

APPENDIX A - Acronyms, Definitions, Nomenclature and Units of Measurement

APPENDIX B - Scope of Work

APPENDIX C - Professional Profiles

APPENDIX D - Boring Logs and Well Completion Summaries

APPENDIX E - Raw Water and Soil Quality Data

APPENDIX F - Pump and Recovery Test Results

APPENDIX G - Sampling and Quality Assurance Procedures

APPENDIX H - Chain of Custody Documentation

APPENDIX I - Standard Laboratory Analytical Protocols

APPENDIX J - State and Federal Drinking Water and Human Health Standards, Criteria and Guidelines Applicable in the State of New York

APPENDIX K - Net Weight of Selected Analytes in Battery Acid Pits

WESTON

EXECUTIVE SUMMARY

ES-1 INTRODUCTION

Roy F. Weston, Inc. (WESTON) has been retained by the United States Air Force Occupational and Environmental Health Laboratory (OEHL) Contract No. F33615-80-D-4006, to provide general engineering, hydrological and analytical services. The OEHL issued Task Order 41 of this contract on 11 May 1984, directing WESTON to complete a subsurface investigation of sites at Griffiss Air Force Base, Rome, New York, that have recently been identified as possible sources of soils and ground water contamination. The field investigation was started on 13 June 1984 and completed on 29 August 1984.

ES-2 SITE PROFILE

Griffiss Air Force Base occupies approximately 3900 acres of land located within the broad, relatively flat lowlands that comprise the Mohawk River Valley in central New York State, near the city of Rome.

The three sites identified by the Air Force for investigation under this task order have each received attention because of problems that occurred or were identified during 1983. These problems included fuel spillage at the Tank Farm and near Building 210, Battery Acid Disposal Pits in Buildings 101 and 222, and the occurrence of a leachate seep area at Landfill 7. These sites were identified during the IRP Phase I.

Most of the Base is directly underlain by glacially derived sand and gravel deposits. The water table occurs in these deposits approximately 10-20 feet below the ground surface. The saturated zone of these sediments comprises the principle ground water bearing zone in the region.

ES-3 SCOPE OF WORK

The field investigation under Task Order 41 included completion of 40 soil borings and the installation of 40 temporary well points to investigate possible fuel oil contamination of areas around Building 210 and the Tank Farm. This was followed by the installation of ten permanent ground water monitoring wells in these areas. Four permanent monitoring wells were also installed around Landfill 7. A single soil boring was completed in each of

the two Battery Acid Disposal Pits to obtain soil and sludge samples for chemical analyses.

The primary contaminants associated with the Tank Farm and Building 210 are petroleum-based fuel products. They may occur as dissolved constituents in the ground water or as a separate liquid phase in ground water and soils. Landfill 7 was operated between 1950 and 1954, and may have been a depository for limited amounts of spent solvents and other chemical waste. Based on the above, ground water samples at the Tank Farm and Building 210 were taken for analysis of total organic carbon, oils and grease, and lead. Samples from wells and a seepage area at Landfill 7 were analyzed for the same parameters, plus phenols, volatile organic compounds and additional metals on the EPA Priority Pollutant list. Soil and sludge samples from the two Battery Acid Disposal Pits were analyzed for metals: iron, lead, copper, manganese, zinc, antimony and chromium.

ES-4 SUMMARY OF FINDINGS

Based on the results of this Phase II, Stage 2 study at Griffiss AFB, Rome, New York, the following key conclusions are drawn:

1. The Base is underlain by unconsolidated permeable sands and gravels of glacial origin. Ground water occurs under shallow water table conditions throughout the Base. Flow is generally toward the south and southwest.

2. The velocity of ground water flow varies with the gradient which is in a large part influenced by direct precipitation recharge. Recharge in the central Base area where the Tank Farm, Building 210, and the Battery Acid Pits are located is limited by building and paving cover. Thus, gradients and seepage velocities are low (10 feet per year). In contrast, permeable cover soils at Landfill 7 allow abundant percolation through the landfill, causing ground-water mounding and a steep hydraulic gradient, with ground water seepage velocities on the order of 300 feet per year.

3. Fuel product contamination of soils and ground water is evident at the Tank Farm near tanks, loading areas, and at the parking lot area of Building 3. However, extensive migration of fuel product on the ground water surface has not occurred. Contamination of soils at Building 3 may be associated with past activities at that site, rather than associated with the Tank Farm.

Although downgradient monitor wells are not showing the presence of fuel product as a separate phase, analysis for dissolved constituents confirmed the presence of oil and grease compounds and total organic carbon above background levels. Lead was detected in only one well and occurred at levels well below minimum EPA Primary Drinking Water Standards.

4. No soil contamination or fuel product as a separate phase was observed at Building 210. Samples from both downgradient wells, however, had levels of oils and grease and total organic carbon comparable to the Tank Farm well samples.

5. The shallow water table and high permeability of native soils at Landfill 7 indicate the potential for percolation of direct precipitation through the landfill to carry contaminants to the ground water. Water quality results from the five wells and one seep at the site indicate an impact on ground water, particularly for oils and grease and total organic carbon. A mounding is evident in the ground water surface at the site, and the ground water surface may intersect the base of the landfill, although this is not confirmed. The seepage in the southeast corner of the site is an expression of the high water table, perched on an underlying till, and not due to direct leachate from the landfill.

6. Soil and sludge samples taken from depths of 0-2 feet in the Battery Acid Pits contained elevated levels of lead, copper, antimony and zinc. These concentrations dropped abruptly with depth to background or near-background levels.

ES-5 RECOMMENDATIONS

The findings of this Phase II, Stage 2 study at Griffiss AFB indicate the need for limited follow-up work at Landfill 7. In addition, a remedial effort should proceed at the Tank Farm and the Battery Acid pits. Potential remedial actions for these sites are discussed in the following sections.

ES-5.1 TANK FARM

Because of the observed impact on soil and ground water due to past fuel spills in the TANK FARM AREA, it is recommended that the Air Force proceed with a remediation phase at that site. Section 6.5 outlines the general steps that would be included in a remedial action assessment. The actual remedi-

al action taken at the site should be based on this assessment which would include the cost-benefit of any action as well as its technical feasibility.

The following initial site specific observations are also added regarding remediation at the Tank Farm Site:

1. Floating fuel product on the ground water surface appears very limited. A skimmer well type recovery system would not be very efficient or produce a large recovery of fuel.

2. Soil contamination by fuel product is widespread and provides a source of contamination to the ground water. Remediation of soil contamination at and above the water table should be examined. Because the large volumes involved, in situ or on site treatment methods may be preferable to disposal of contamination soils.

ES-5.2 LANDFILL 7

Landfill 7 has been closed for thirty years. The area is graded with a good grass cover. Ground water samples contained one Priority Pollutant Volatile Organic Compound (Tetrachloroethylene), which was elevated at one well (MW-17, 105 Mg/l). TOC was also elevated in most monitor wells. Elevated TOC is most likely due to the breakdown of cellulose material in the landfill. However, the possible presence of Priority Pollutant Organic Compounds should be ruled out by additional selective sampling. The results of these analyses will determine what, if any, additional remediation is appropriate. Therefore, additional sampling is recommended:

1. All wells should be resampled to confirm the results of the first round of analyses.

2. All well samples, samples from the seep, and two surface water samples should be analyzed for chloride, boron and sulfate.

3. MW-16 and MW-17 where TOC levels were highest, should be sampled for EPA Priority Pollutant base neutral/acid extractable compounds, and pesticides.

ES-5.3 BATTERY ACID DISPOSAL PITS

1 No further investigation of the Battery Acid Disposal Pits is recommended. However, the pits should be properly sealed to prevent their use for disposal of any liquids, including clean water, which could drive contaminants to the water table.

2. A remedial action assessment as discussed in section 6.6 should be initiated to determine suitable remedial alternatives for these pits. In situ, isolation or removal and disposal are possible alternatives for the small volume of sludge involved (less than 40 cubic feet).

3. EP Toxicity Tests should be performed on samples from each pit.

SECTION 1

INTRODUCTION

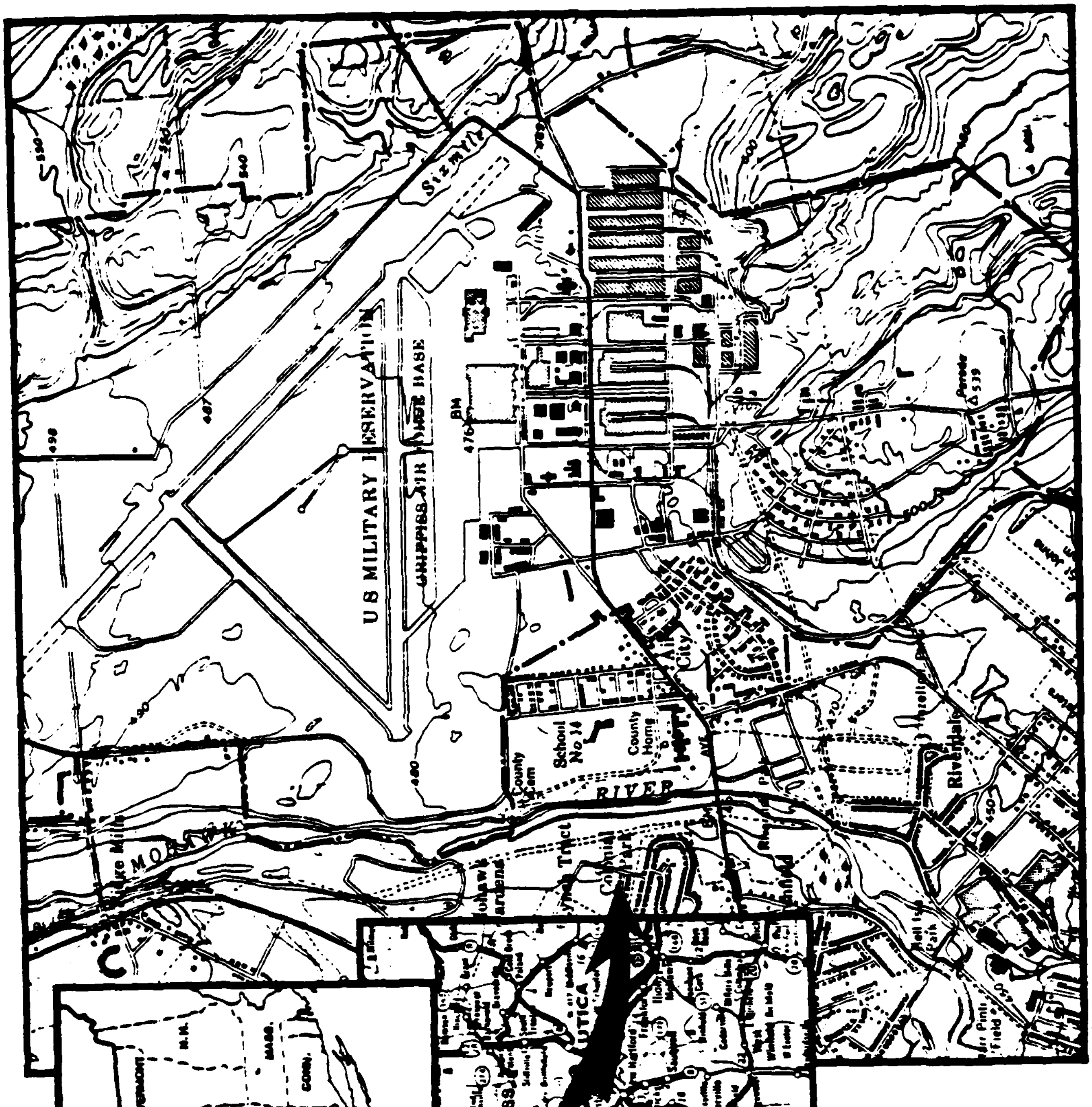
1.1 PURPOSE AND SCOPE

Roy F. Weston, Inc. (WESTON) has been retained by the United States Air Force Occupational and Environmental Health Laboratory (OEHL) under a Contract No. F33615-80-D-4006, to provide general engineering, hydrological and analytical services. The OEHL issued Task Order 41 of this contract on 11 May 1984, directing WESTON to complete a subsurface investigation of sites at Griffiss Air Force Base, Rome, New York, that have recently been identified as possible sources of soils and ground water contamination. The purpose of this task was to determine if environmental contamination has resulted from waste disposal and fuel handling practices at Griffiss AFB, to identify the potential environmental consequences of such contamination, the magnitude and extent of existing contamination, and the potential for migration. The full investigation was started on 13 June 1984 and completed on 29 August 1984. The following sub-sections present a brief history and description of these sites.

1.2 SITE PROFILE

Griffiss Air Force Base occupies approximately 3900 acres of land located within the broad, relatively flat lowlands that comprise the Mohawk River Valley in central New York State, as shown in Figure 1-1. The nearest cities to the Base are Rome, which is approximately two miles southwest of the Base boundary, and Utica, approximately 16 miles to the southeast.

The three sites identified by the Air Force for investigation under this task order have each received attention because of problems that occurred or were identified during 1983. These problems have included fuel spillage at the Tank Farm and near Building 210, Battery Acid Disposal Pits in Buildings 101 and 222, and the occurrence of a leachate seep area at Landfill 7. These locations are shown on the general site map, Figure 1-2. The following sections



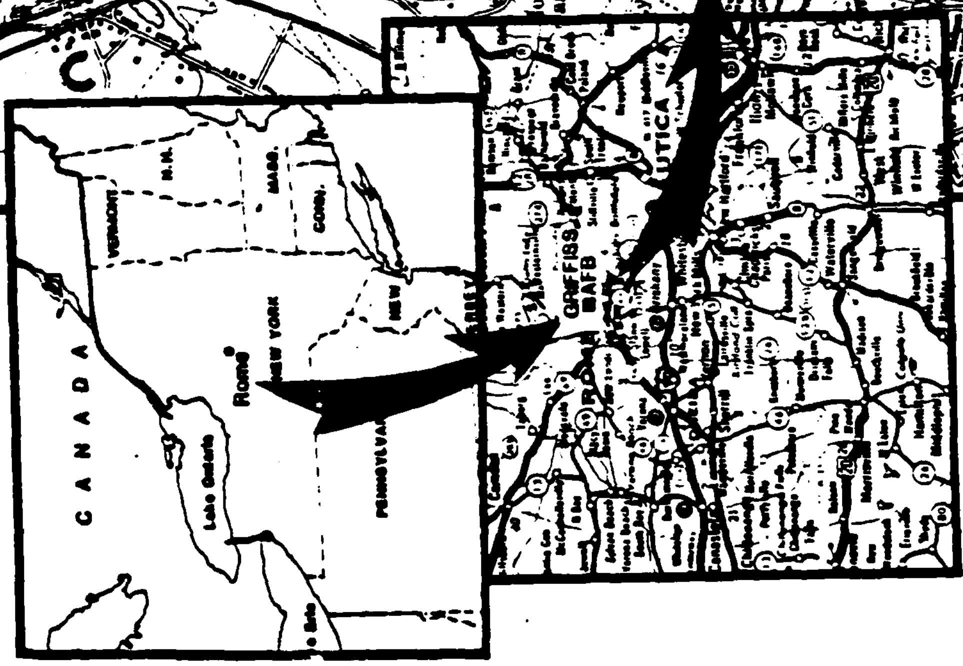


FIGURE 1-1 INDEX MAP OF GRIFFISS AIR FORCE BASE ROME, NY

N

WESTON

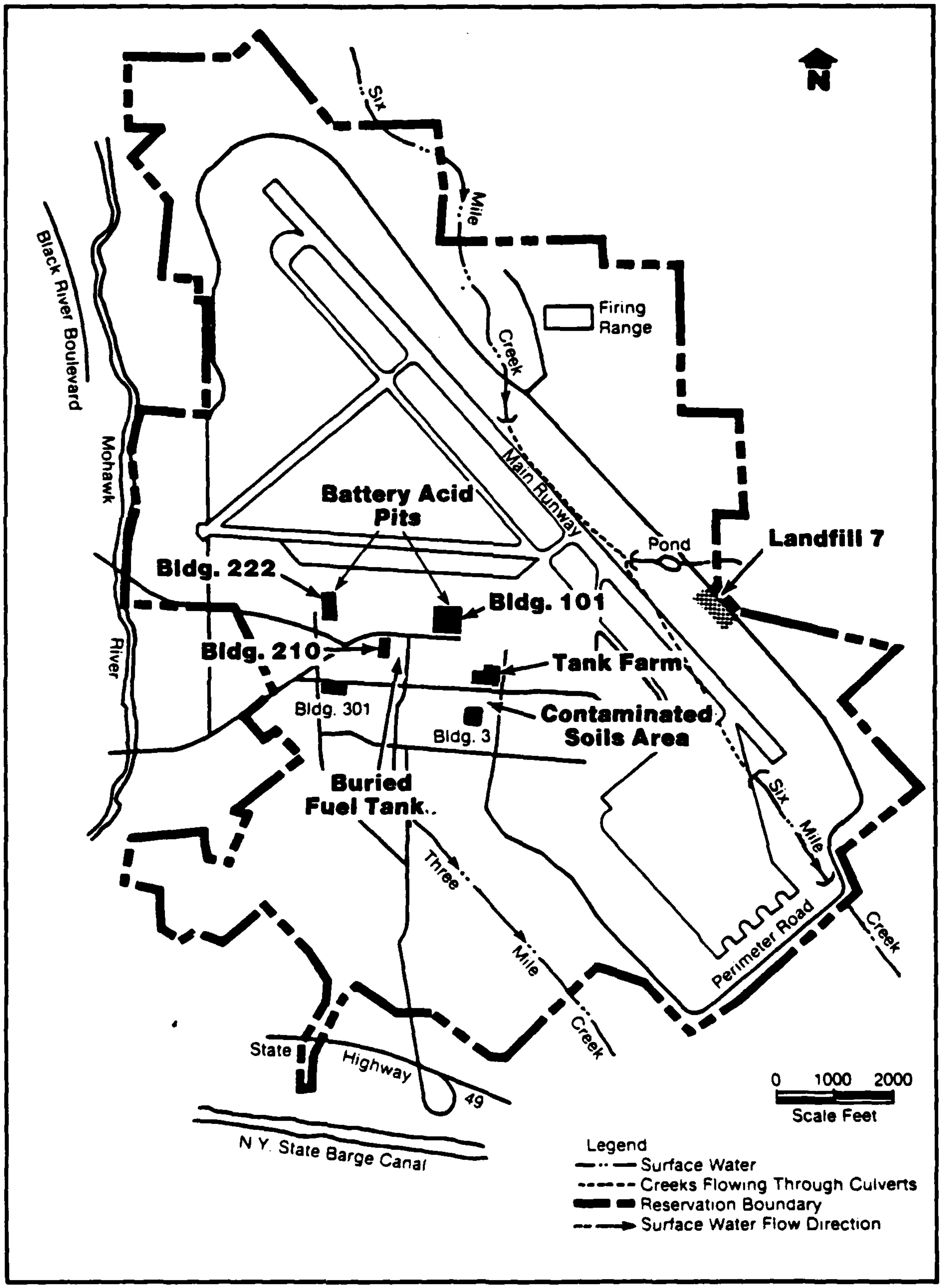


FIGURE 1-2 LOCATIONS OF AREAS OF INVESTIGATION GRIFFISS AIR FORCE BASE, ROME, NEW YORK

present a brief description of each of the sites along with a background discussion of the problems identified.

1.2.1 Tank Farm Area

The Tank Farm Area actually consists of two adjacent Tank Farms numbered 1 and 3, as shown in Figure 1-3. Since their construction in 1943, the Tank Farms have been used for the storage of Avgas, Mogas, JP-4, FS-6, and propanol. Tank Farm 1 consists of nine active and two inactive buried tanks for Avgas, Mogas and JP-4. These tanks range in capacity from 25,000 to 29,000 gallons. There is also an above ground propanol tank in Tank Farm 1. Tank Farm 3 consists of three above ground storage tanks (161, 162 and 163) containing No. 6 fuel oil and four 25,000 gallon underground storage tanks containing JP-4. In the fall of 1982, investigative soil borings to the south of the Tank Farm area for a steam pipeline construction project found measurable quantities of what appeared to be light fuel product in the ground water.

On October 3-7, 1983, thirty test borings were augered by a drilling contractor along the proposed steam pipeline route. The location of these borings is shown on Figure 1-3. The borings were made to the water table, and organic vapor monitoring was conducted at each borehole. Fuel vapors were evident in a line of borings to the south of Tank Farm 1, as recorded by an organic vapor detector. As part of this same project, split spoon soil samples were recovered from the boreholes wherever vapor readings were found to exceed 300 ppm. In addition, a ground water sample was recovered at borehole 2 to determine species of product. Soil and water samples were analyzed by OEHL's laboratory. As a result of these analyses, the ground water samples were shown to contain detectable levels of lead, benzenes and xylenes. By these same group of analyses, the soils were found to contain lesser concentrations of these constituents.

On 19 October 1983, as part of New York State's tank-farm monitoring requirements, a single ground water monitoring well was installed at the southeast corner of Tank Farm 3. The well is reportedly constructed to be 32.5 feet deep. On 19 October 1983, a sample was collected of the fuel product floating upon the groundwater surface approximately 15 feet below ground level. USAF OEHL analysis revealed 0.207 mg/gram total hydrocarbon, with head space analysis showing volatile hydrocarbons such as JP-4 gasoline or diesel fuel.

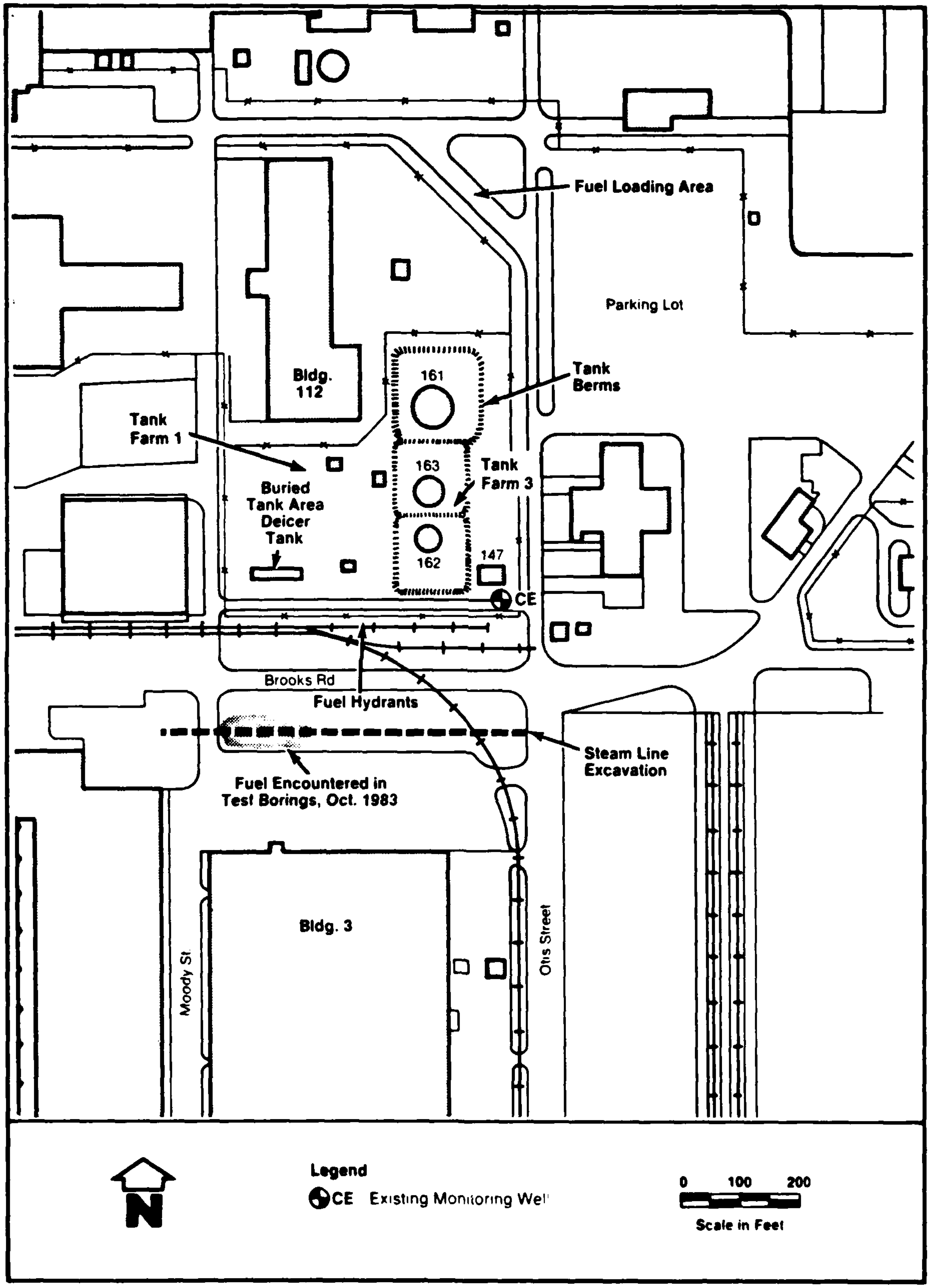


FIGURE 1-3 TANK FARM AREA SITE MAP

The Base has reported that there have been no significant inventory losses from the Tank Farm and, therefore, the fuel contamination observed in the ground water is most likely due to numerous small spills or minor pipeline joint leaks that have occurred over the past years. Fuel has been continually reported in the hydrant pits of this Tank Farm. These pits are gravel bottomed. During WESTON's field investigation, described in this report, Base personnel informed WESTON that at one time there was a truck maintenance shed north of Building 3 at the location of the test borings. Waste fuels were reportedly disposed directly into the subsoil through a dry well. This past activity could have been at least partially responsible for detected products in the test borings.

1.2.2. Building 210, Buried Tank

To the west and north of the Tank Farm area is Building 210 which is a water treatment facility. This facility is shown on Figure 1-4. A 275 gallon underground gasoline tank is located along the east side of the building. On 6 January 1984, during excavation near the tank, a leak was discovered and reported by Base personnel. Subsequently, a regular inventory loss, as high as 7 inches per day, was reported to have been occurring from the tank for an indefinite period of time. Since these incidents, the tank has been taken out of service and replaced with an above-ground tank. In November 1984, the tank was removed and replaced with a new buried steel tank.

1.2.3 Battery Acid Disposal Pits

Battery acid disposal pits have been used since the early 1940's in truck maintenance Building 222 and in the battery service shop in Building 101. In both cases, these pits are simply openings in the concrete floors, approximately 2 x 2 feet, covered with steel grates. After the battery acid was neutralized with baking soda, the neutralized liquid from spent batteries was dumped into the pits and allowed to percolate into the underlying soil. Grab samples of the residual sludge sampled by the Air Force showed elevated levels of metals, particularly lead which was in the parts per thousand concentration range. The actual depth of contaminated sludge and soil was not determined.

1.2.4 Landfill 7

Landfill 7 occupies approximately 4.5 acres located on the northeast side of the main runway, as shown on Figures 1-2 and 1-5. The landfill was active between 1950 and 1954, and

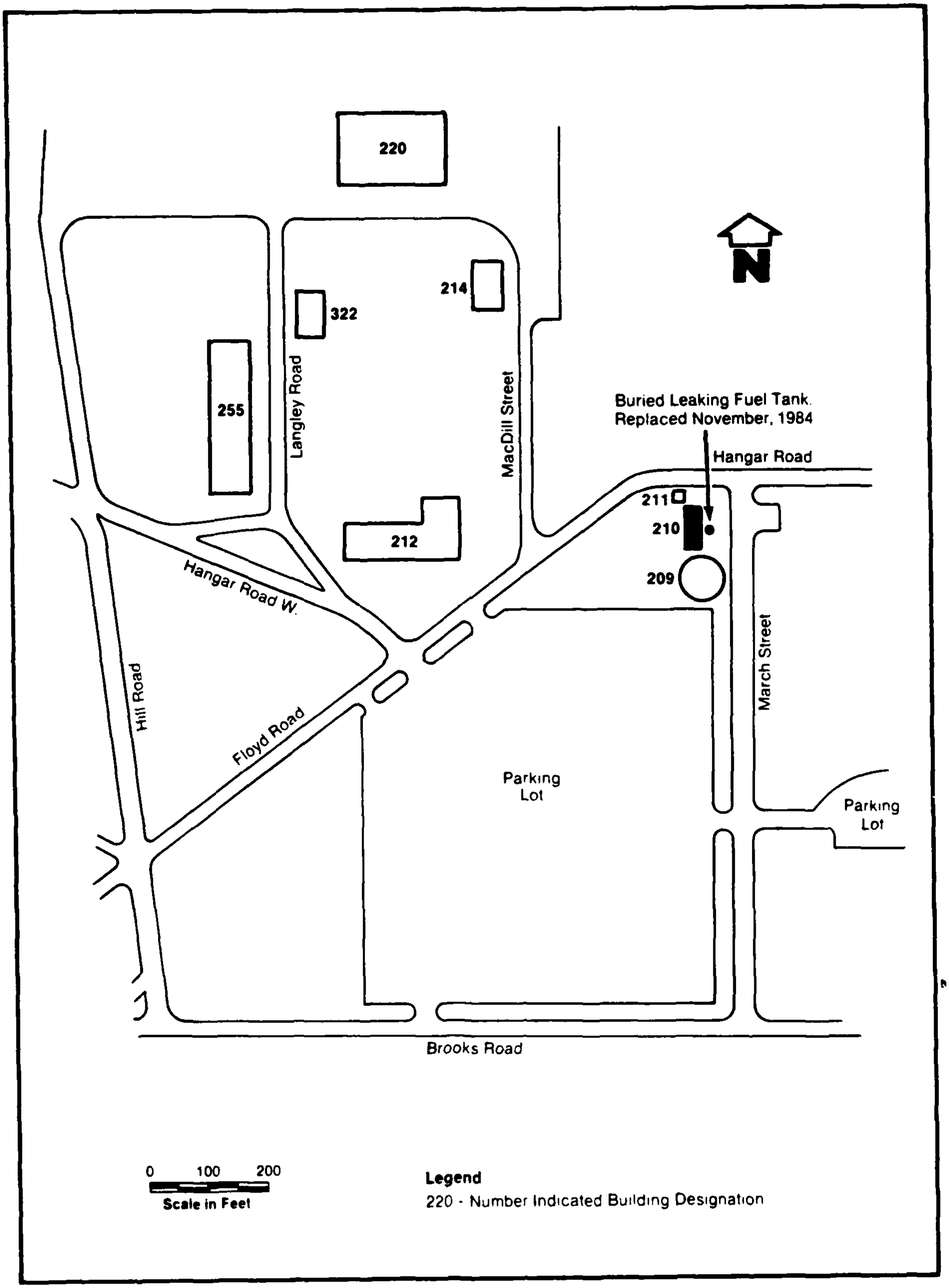


FIGURE 1-4 BURIED FUEL TANK SITE MAP

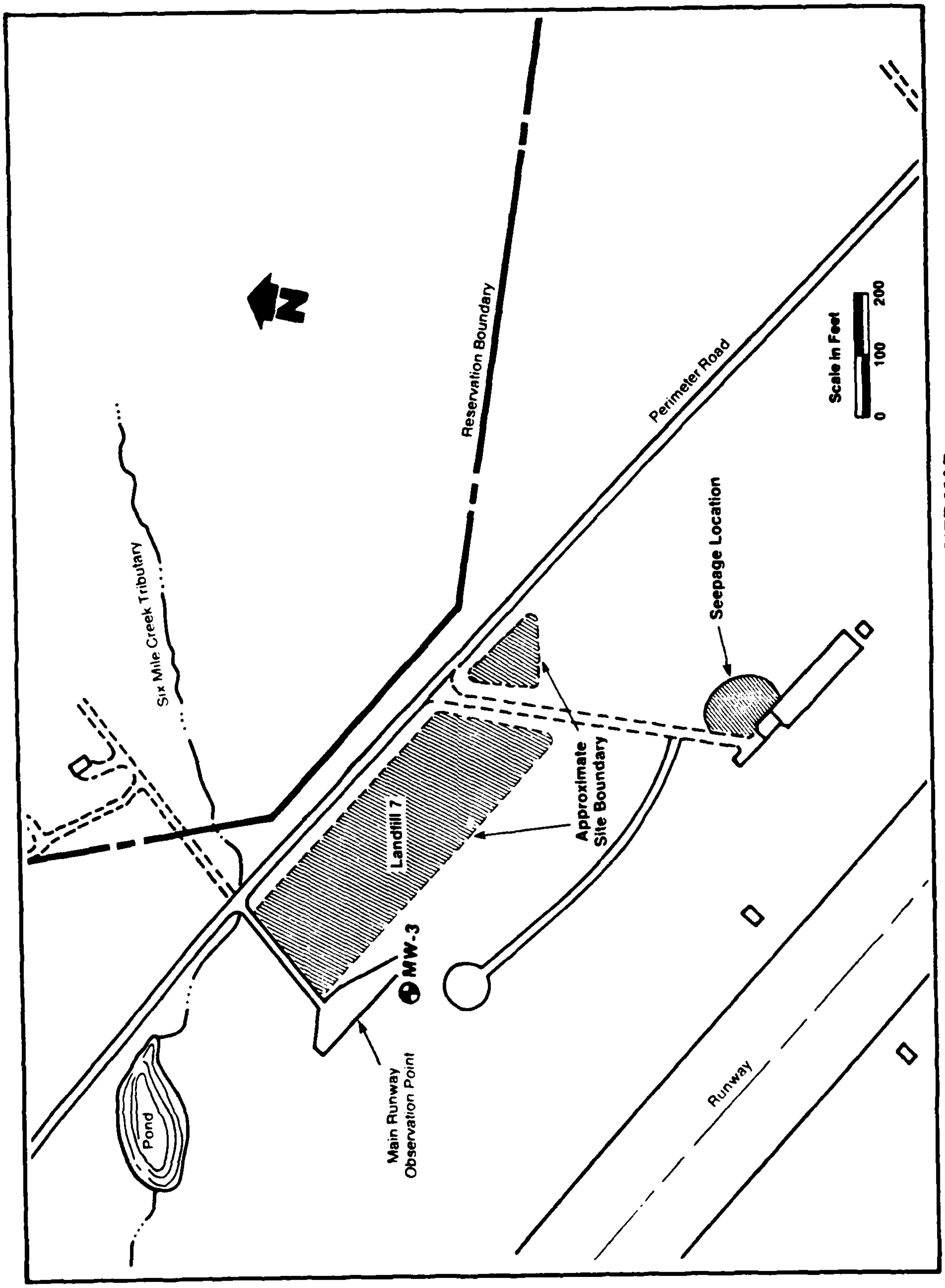


FIGURE 1-5 LANDFILL NO. 7 - SITE MAP

contains domestic refuse type wastes, all of which were burned in trenches. The landfill is located on a topographic high, is now almost completely grass covered, and is indistinguishable from adjacent areas. There is evidence that burrowing animals have disturbed some of the burned residues from the landfill. Other than a single localized depression on the landfill surface, probably caused by differential settlement, the site has been graded and maintained to promote surface runoff in all directions. Grass cover was good and no serious erosion was observed. There was no evidence of leachate prior to 1982.

Monitor Well W-3 was installed in November 1981 adjacent to the southwest corner of Landfill 7 in a downgradient direction between the landfill and Six Mile Creek. Subsurface materials sampled during monitor well construction were predominantly fine to coarse-grained sands. No bedrock or till was encountered in this boring, which was 32 feet deep. Ground water quality analyses of samples from well W-3 detected no compounds at concentrations which would cause immediate environmental concern. Due to the age of this landfill, the probability that significant leachate generation would occur in the future was considered to be low. Therefore, no further actions were recommended at Landfill 7.

In November 1983, Base environmental personnel reported that leachate was observed in the southeast corner of Landfill 7. The leachate consisted of several inches of oily water, covering a depression adjacent to a runway-instrument station. Water samples from the leachate stream were discolored and had a strong ammonia odor.

1.3 CONTAMINATION PROFILE

The primary contaminants associated with the Tank Farm and Building 210 are petroleum-based fuel products. Contaminants may occur as dissolved constituents in the ground water or as a separate liquid phase in ground water and soils. Landfill 7 was operated between 1950 and 1954, and may have been a depository for limited amounts of spent solvents and other chemical waste. Based on the above, ground water samples at the Tank Farm and Building 210 were taken for analysis of total organic carbon, oils and grease, and lead. Samples from wells at Landfill 7 were analyzed for the same parameters, plus phenols, volatile organic compounds and additional metals on the EPA Priority Pollutant list.

The dry wells were the recipients of neutralized battery acid solutions. The primary constituents of concern in the battery sludge are metals. A summary of all analytes for ground water and soil/sludge samples is presented in Table 1-1.

1.4 PROJECT TEAM

The Phase II Confirmation Study at Griffiss AFB was conducted by staff personnel of Roy F. Weston,Inc., and was managed through WESTON's home office in West Chester, Pennsylvania.

The following personnel served lead functions in this project:

MR. PETER J. MARKS, PROGRAM MANAGER: Corporate Vice President and Manager of Laboratory Services, Master of Science in Environmental Science (M.S.), 18 years of experience in laboratory analysis and applied environmental science.

MR. FREDERICK BOPP, III, PH.D., P.G., PROJECT MANAGER: Doctor of Philosophy (Ph.D.) in Geology and Geochemistry, Registered Professional Geologist (P.G.), over 10 years of experience in hydrogeology and applied geological science.

MR. RICHARD C. JOHNSON, P.G., PROJECT GEOLOGIST: Master of Arts (M.A.) in Geology, Registered Professional Geologist, 7 years experience in geotechnical engineering and hydrogeology.

MR. WALTER M.LEIS, P.G., GEOTECHNICAL QUALITY ASSURANCE OFFICER: Corporate Vice President and Manager of the Geosciences Department, M.S. in Geological Sciences, Registered Professional Geologist, over 13 years of experience in hydrogeology and applied geological services.

MR. EARL HANSEN, PH.D, ANALYTICAL LABORATORY MANAGER: Doctor of Philosophy (Ph.D.) in Chemistry, over 15 years of experience in Laboratory Analysis.

MS. DEBORAH L. JONES, ASSISTANT SOIL SCIENTIST: M.S. in Environmental Pollution Control, 2 years experience in investigations in soil and ground water contamination.

TABLE 1 -1

ANALYTICAL PROTOCOL

SITE	POTENTIAL CONTAMINANTS	MEDIUM	ANALYTES
TANK FARM and BLDG 210	Fuel Products	Groundwater	.Oil and Grease •Lead .Total Organic Carbon (TOC)
LANDFILL 7	Spent Solvents Petroleum Products	Groundwater	.Total Organic Carbon (TOC) .Oil and Grease .Volatile Organic Compounds(VOC .Phenols .Metals (As, Cd,Pb,Hg,Cr, Ni, Ag, Cu).
BATTERY ACID DISPOSAL PITS	Battery Acid Sludges	Soil, Sludge-solids	Metals (Fe. Pb, Cu, Sb, Mn, Zn, Cr)

Professional profiles of these key personnel, as well as other project personnel, are contained in Appendix C.

1.4.1 Subcontracting

All drilling and well installation for this project was performed by Empire Soils, Inc. of Groton, New York under contract to Roy F. Weston, Inc. All work was conducted under the direction of the on-site WESTON geologist or soil scientist.

SECTION 2

ENVIRONMENTAL SETTING

2.1 REGIONAL GEOLOGY

Griffiss Air Force Base (Griffiss) is located at the eastern edge of the Central Lowland Physiographic Province of the northeastern United States. Bedrock at Griffiss is the Utica Shale of Ordovician age. The Utica is a relatively soft, black to dark grey calcareous shale which was derived by erosion of sediments from the newly uplifted Catskill and Taconic Mountains to the east and southeast. It is nearly flat-lying in the Griffiss area, with maximum bedding dips of only 5° to 6° (SW) reported in a few miles radius from the Base. The Utica Shale is known to be jointed in the area. Most planar openings (joints) are nearly vertical, and the dominant joint set trends to the east and southeast along the trend of the Mohawk Valley itself.

The Griffiss area is known to have been glaciated during the Pleistocene Epoch. As a result of this glaciation, the surface of the Utica Shale has been gouged and scoured by ice action into a gently undulating surface. A series of varying types of unconsolidated deposits are known to overly the Utica Shale unconformably, and each of these deposits owes its origin to the presence of glaciers nearby. The deposits immediately overlying the Utica Shale are Pleistocene age lake deposit and glacio-fluvial fine sands, silty sands, silts and sandy clays which were formed in association with the now-extinct glacial Lake Iriquois. Overlying these deposits, and in some areas laterally equivalent to them, are more recent alluvial and glacially derived delta deposits of medium to coarse-grained sands and gravels formed in association with outwash of sediments from retreating glaciers. At Griffiss, the few topographic highs present are capped by the coarse-grained alluvial and deltaic deposits, with the fine grained lake deposits dominating the lower lying areas.

2.2 TOPOGRAPHY AND SURFACE DRAINAGE

Elevations across most of Griffiss average about 475 feet above a mean sea level datum (MSL). Most of the base north of Floyd Avenue has been subjected to cut and fill operations during construction of the airfield portion of the base, and in that area local relief rarely exceeds 10 feet. The land surface at the southern end of the Base, south of Three Mile Creek, rises to about 600 feet elevation. To the north of the Base, the topography rises to above 510 feet.

The main surface drainage on the base is comprised of the following two streams: (1) Three Mile Creek, which begins in the south-central portion of the Base at two drainage culvert discharge points that carry Base storm water. Three Mile Creek flows generally southeasterly past much of the residential portion of the Base, and discharges off-Base into the New York State Barge Canal; (2) Six Mile Creek, which enters the Base at the north boundary, flows generally southeasterly across most of the northeastern perimeter of the base, continues southeasterly through an underground culvert under the main runway and discharges off the southeasterly base boundary into the New York State Barge Canal. The Mohawk River flows north to south just to the west of the Base, turns east south of the Base, where it is channelized as the New York State Barge Canal.

2.3 GROUND WATER OCCURRENCE

Most of the potable waters supplied to consumers via municipal systems in the Mohawk Valley are derived from surface waters. By some estimates, surface waters may supply as much as 95 percent of all municipal waters consumed in the region. Ground waters are used dominantly for domestic supplies and farm irrigation, in areas outlying municipal distribution systems. Three main units comprise the available ground water aquifers at Griffiss.

- Quaternary Age lacustrine and alluvial deposits comprise an unconsolidated, unconfined aquifer made up of primarily fine-grained sediment. These deposits vary in thickness from 10 to 150 feet in the area. Wells screened into this unit average 68 feet in depth near Griffiss. The well yields range from 4 to 40 gallons per minute, averaging 11 gpm. Water derived

from this unit is of variable quality, and is usually hard. These sediments were observed as recent reworked sediments in Six Mile and Three Mile Creek Flood Plains on the Base, where ground water occurred within 5 feet of the ground surface.

- Quaternary Age glacial deposits make up an unconsolidated, unconfined aquifer comprised of primarily coarse-grained sediments, and occasional clay tills. These deposits vary in thickness from 10 to 140 feet in the area. Wells screened into this unit average 67 feet in depth near Griffiss. These sediments form the most productive water bearing unit of the region, with typical yields varying from 10 to 290 gallons per minute, averaging 80 gpm. The water is reported to be of good quality. Most of Griffiss AFB is directly underlain by these sediments. The unconsolidated sediments units receive recharge from precipitation and from surface stream flow during wet periods. Ground water is found within 10 to 15 feet of the ground surface in most areas of the Base where these sediments occur. Water is deeper in topographically higher areas.

- The Utica shale comprises a consolidated, usually unconfined ground water bearing zone containing water in weathered upper zones, in joints, bedding planes and in secondary fissures. This unit may function under confined (artesian) conditions only locally. The unit ranges in thickness in the region from 300 to 400 feet and typical yields are relatively small and range from 0.5 to 48 gallons per minute, averaging 7.5 gpm. The Utica shale was encountered less than 15 feet below the surface in the extreme northern area of the Base, but is at least 35 feet deep and possibly as deep as 80 feet in other areas.

  Water supplies are normally drawn from upper reaches of this unit, since unit

permeability declines with depth, and deeper strata may be naturally contaminated by salts, hydrogen sulfide or methane.

2.4 SITE HYDROGEOLOGY

2.4.1 Tank Farm, Building 210, and Battery Acid Disposal Pits

Based on the evidence of shallow borings, including Monitor Well 2 near Building 301 and investigative borings near the Tank Farm, the central part of the base south of the runway where the Tank Farm, Building 210, and the dry wells are located is directly underlain by glacially derived coarse sands and gravels. These sediments have been estimated to be as thick as 80 feet and overlie the Utica Shale. The sediments constitute a highly permeable unconfined aquifer with the water table lying about 15 feet below the ground surface. Recharge to the water table is primarily through direct precipitation and percolation through the porous overlying soils. The major flow path of shallow ground water is toward nearby surface streams, where it is discharged as base flow. Because a large proportion of the study area is paved or covered by buildings, much of the potential recharge is carried directly to nearby streams by the Base storm drain system.

2.4.2 Landfill 7

Landfill 7, shown in Figure 1-5, is located to the north and adjacent to the main Base runway. The site occupies a local topographic high. A buried culvert carrying 6 Mile Creek is located to the south, and a tributary to 6 Mile Creek is to the northwest of the site. The tributary flows into a pond before it enters the culvert. Ground water flow would be expected to exit the site to the south and west toward the surface streams. However, because of the topographic high, there is probably mounding of the water table and some radial flow in other directions. The wet area observed on the southeast corner of the landfill may be an expression of a high ground water table intersecting the land surface and disposal area, or it may be an expression of slowly percolating waters that are perched in the relatively impermeable layers in the landfill above the water table. A detailed discussion of this condition is presented in Section 4.2.3.

SECTION 3

SITE INVESTIGATION

3.0 INTRODUCTION

The field investigation conducted at Griffiss Air Force Base was started on 25 June 1984 and was completed on 29 August 1984. The scope of work under Task Order 41 is summarized in Table 3-1. The complete work scope under this task order is included in Appendix B. Table 3-2 is a summary calender of WESTON's field activities for this investigation.

3.1 DRILLING PROGRAM

The field investigation at Griffiss Air Force Base included the completion of 42 Soil Borings and the installation of 40 temporary well points and 10 permanent monitoring wells. The work was performed by drill crews from Empire Soils Investigations, Groton, New York, under the direction of WESTON geologists and soil scientists. Two rigs were used on-site to complete the drilling program. A truck mounted CME-75 drill rig was used to install all permanent monitoring wells. A smaller trailer-mounted rig was used for the exploratory soil borings at the Tank Farm and Building 201, and for Battery Acid Disposal Pit sampling at Building 222. A hand operated tripod mount was used to sample the Battery Acid Disposal Pit in Building 101. Drilling started on 25 June 1984 and was completed on 11 July 1984. Prior to drilling, all locations were cleared for buried utilities by Base personnel. WESTON also performed a ground penetrating radar (GPR) scan of all locations as a confirmation of the lack of obstructions.

3.1.1 Preliminary Geophysical Survey

A ground penetrating radar (GPR) survey was completed at each proposed boring location at the Tank Farm and Building 210. The purpose of this survey was to verify the absence of subsurface facilities. This effort was done in addition to obtaining clearance from Base personnel for all utility services. GPR can be used to locate buried objects such as pipes, cables, or conduits. The product of a GPR survey is a series of subsurface profiles that display the various interfaces encountered.

TABLE 3 - 1

Summary of Technical Work Scope

SITE	ACTION
Tank Farm Area	. 33 soil borings completed with sampling every 5 feet and installation of temporary well points for groundwater elevation survey and determination of contamination distribution.
	. 8 monitoring wells installed for groundwater sampling
	. Groundwater sampling from new and existing monitoring wells.
	. Water level and fuel product thickness measurements taken.
	. Pump and recovery tests performed on 3 monitoring wells to determine hydraulic conductivity and transmissivity of the aquifer.
	. Ground-penetrating radar survey completed.
Building 210	. 7 soil borings with sampling every 5 feet and installation of temporary well points for groundwater elevation survey and determination of contamination distribution.
	. 2 monitoring wells installed for groundwater sampling.
	. Groundwater sampling from monitor wells.
	. Water level and fuel product thickness measurements taken.
Landfill 7	. 4 monitoring wells installed for groundwater sampling and water table elevation survey
	. Groundwater sampling from new and existing monitor wells.
	. Water level measurements taken.

TABLE 3 - 1
(continued)

Summary of Technical Work Scope

Landfill 7 (cont.)	. Slug and recovery tests performed on 2 monitoring wells to determine hydraulic conductivity and transmissivity of the aquifer. . Leachate seep sampled for chemical characterization analysis.
Building 101 & 222	. Battery acid pits sampled.

Table 3 - 2

Field Activity Schedule

Date	Activity
13 June 84	Site visit to locate boring and monitor well sites.
25 - 26 June 84	Ground penetrating radar survey at Tank Farm completed.
25 June 84	Mobilization of drilling rigs to install monitoring wells and soil borings.
5 July 84	Battery acid pits sampled.
9 July 84	Soil borings and temporary well points completed.
10 July 84	First round of water level and fuel product thickness measurements taken.
17 July 84	Monitoring well installation and development completed.
14 - 18 August 84	Sampling of all monitor wells completed and slug and recovery tests performed on some wells at Landfill 7 and the Tank Farm Area. Second round of groundwater levels and fuel product thickness measurements taken.
17 August 84	Leachate seep at Landfill 7 sampled for chemical characterization analysis.
28 - 29 August 84	Completion of elevation survey. Third round of groundwater levels and fuel product thickness measurements taken.
10 - 11 October 84	Resampling of Landfill 7 wells and seep for Voa's.

Before any traverses were made over the proposed boring locations, the GPR system was calibrated. To do the calibration, either the dielectric constant of the survey medium or the depth to a visible object must be known. Initial calibration was performed by calculating a dielectric constant, which was based on the soil and moisture conditions - a heterogeneous mixture of moist silty sands and gravel. A second calibration was done for quality assurance purposes by traversing a pipe of known diameter and buried at a measurable depth. From this calibration procedure, a vertical depth profile scale was constructed. Thus, points of interest seen on the printout could be converted to actual depths below ground surface.

Traverses were made over each marked location with the GPR antennae to clear the area before drilling. Identification marks were made on the profile at twenty-five foot intervals to orient the printout to the physical environment. Interpretation of the printouts was done immediately on-site, so the soil borings could be drilled if the area was determined to be clear. The locations of some of the borings were adjusted slightly in response to the GPR results, particularly in the Tank Farm 3 area. New locations were then cleared by Base personnel.

3.1.2 Exploratory Soil Borings and Temporary Well Points

A total of 40 soil borings were completed in the Tank Farm and Building 201 areas in the following manner: The borings were advanced with 4 inch inside-diameter hollow-stemmed augers. Soil samples were taken in advance of the augers using a 2 inch-diameter split spoon sampler in accordance with Standard Penetration Test Methods (ASTM-D-1586). Samples were taken at intervals of five feet. Borings were terminated approximately three feet into the water table. At the completion of the boring a 1 1/2-inch diameter PVC pipe with five feet of slotted screen was inserted into the bore hole. The augers were then withdrawn and the annular space was allowed to collapse or was backfilled with drill cuttings. A typical well point construction diagram is shown in Figure 3-1. Boring logs for all well points are included in Appendix D. All samples were logged by a WESTON geologist or soil scientist who recorded information on soil descriptions, sampler blow counts, presence of fuel odors, depth to ground water, and other relevant information. At a later date all temporary well points were removed and the

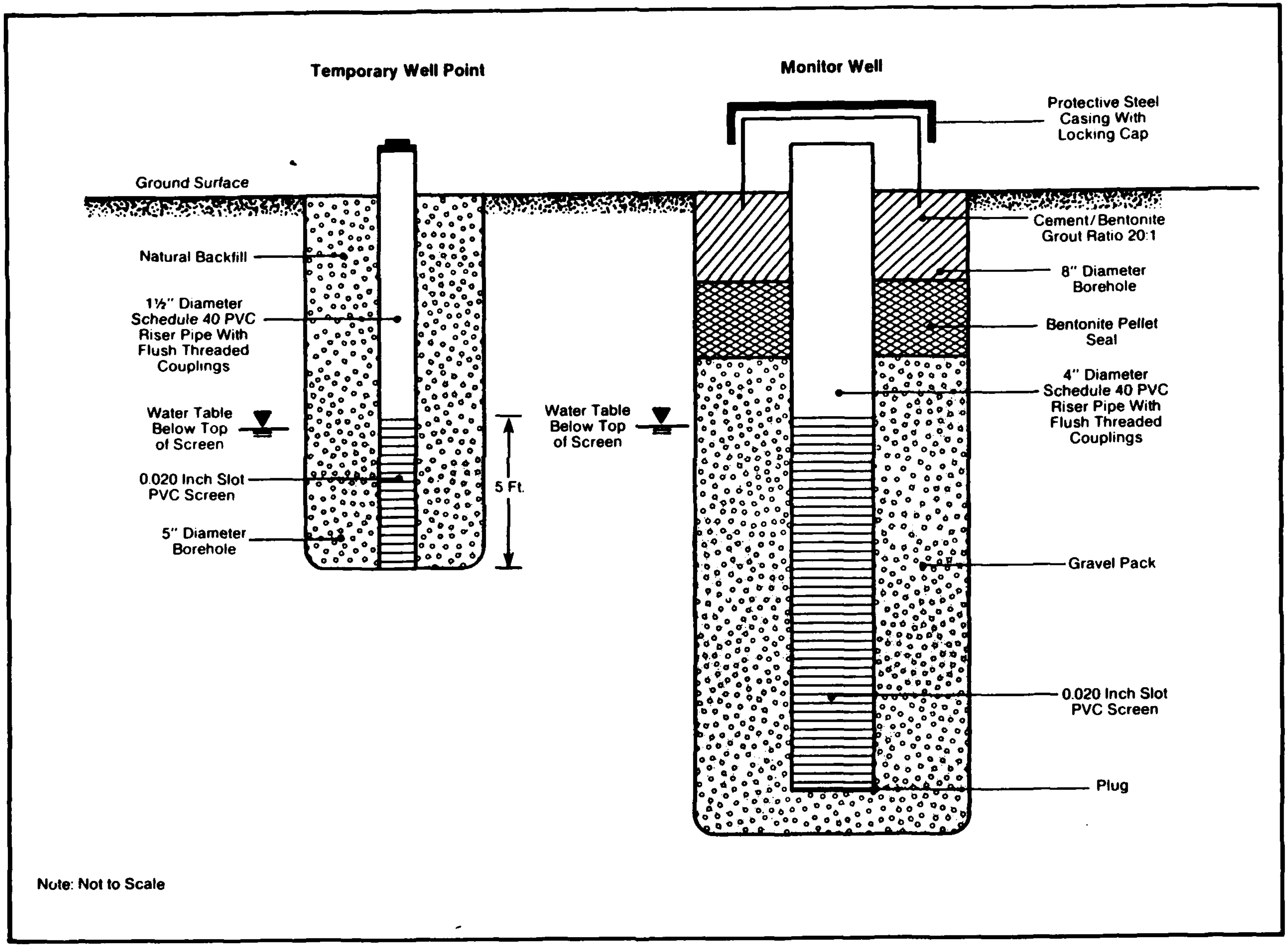


FIGURE 3-1 TYPICAL WELL POINT AND MONITOR WELL CONSTRUCTION

borings were either backfilled or redrilled and permanent 4 inch monitoring wells installed.

3.1.3 MONITOR WELL INSTALLATION

A total of 14 monitoring wells were installed during the field investigation, including two wells installed near Building 210, eight wells around the Tank Farm, and four wells at landfill 7. The following installation methods and construction were utilized for all wells: 6 3/4 inch inside diameter hollow stemmed augers were advanced to approximately twenty feet below the water table or to the top of a low permeability till layer encountered in a few of the borings. Then an appropriate length of 4 inch diameter flush threaded PVC riser pipe and screen was inserted through the augers. The augers were then slowly withdrawn as a sand pack was poured into the annular space around the screen. Bentonite pellets were then placed on top of the sand pack to seal the screened interval from vertical infiltration through the annular space. The seal was completed by filling the annular space to the surface with a non-shrinking cement grout as the augers were withdrawn. Care was taken to prevent collapse of the annular space above the sand pack and to ensure a continuous bentonite and grout seal. Well construction was completed by installing a 6 inch diameter steel protective casing cemented in place over the well head. Where wells were located in traffic areas, a recessed box was used with a cover plate flush with the ground surface. A typical well construction diagram is presented in Figure 3-1. Well completion diagrams for all wells are presented in Appendix D. Each well was developed by pumping a minimum of five times the volume of standing water in the well casings. The only water introduced during drilling was small amounts of single source potable water (less than 50 gallons) to control running sands in several wells. No solvents or glues were used in casing joints.

3.1.4 Elevation Survey

In order to determine ground water elevations at the site, each temporary well point and monitoring well was surveyed to determine top-of-casing elevation. In addition, three references were established on Three Mile Creek, which is a ground water discharge line downgradient of the study sites. Elevations were measured to the nearest .01 feet using an optical leveling device. All elevations except those in the landfill 7 area were referenced to nearby bench marks.

Bench marks were not available at landfill 7, so a reference elevation was assigned from site topographic maps. Survey elevations are relative to mean sea level. Since landfill 7 is remote from the other study sites, the use of an arbitrary local reference does not affect the hydrologic analysis.

3.1.5 Well Monitoring

Well points were measured during the program for depth to ground water and the presence of fuel product on the ground water surface. Water levels were determined to the nearest hundredth of a foot by a battery operated Soil Test Water Level Probe. The presence of fuel oil was determined by sampling the top one foot of the water column with a clear glass bailer with a check valve at its base. The bailer was gently lowered into the water column and allowed to fill from the bottom. Floating fuel was recovered, if present, and the fuel thickness could be directly measured in the bailer.

3.1.6 TANK FARM

A total of 33 soil borings were completed and monitoring points were installed in the tank farm area to identify soil contamination, and determine the subsurface distribution of free floating fuel product and the trend of the ground water flow gradient. Prior to drilling, boring locations were staked out at the site and the locations were cleared for subsurface utilities by base authorities. As a final check for buried objects, WESTON ran ground penetrating radar traverses across the proposed boring locations. As the drilling progressed, several boring locations were moved to respond to additional information gathered. These sites were similarly cleared by base authorities. The final well point locations are shown on Figure 3-2. The locations were chosen for the following reasons:

- Obvious fuel source locations including the tank farm, hydrant lines, and loading dock area.
- The known contaminated area south of the tank farm.
- Upgradient and down gradient locations outside the extent of any visible plumes.

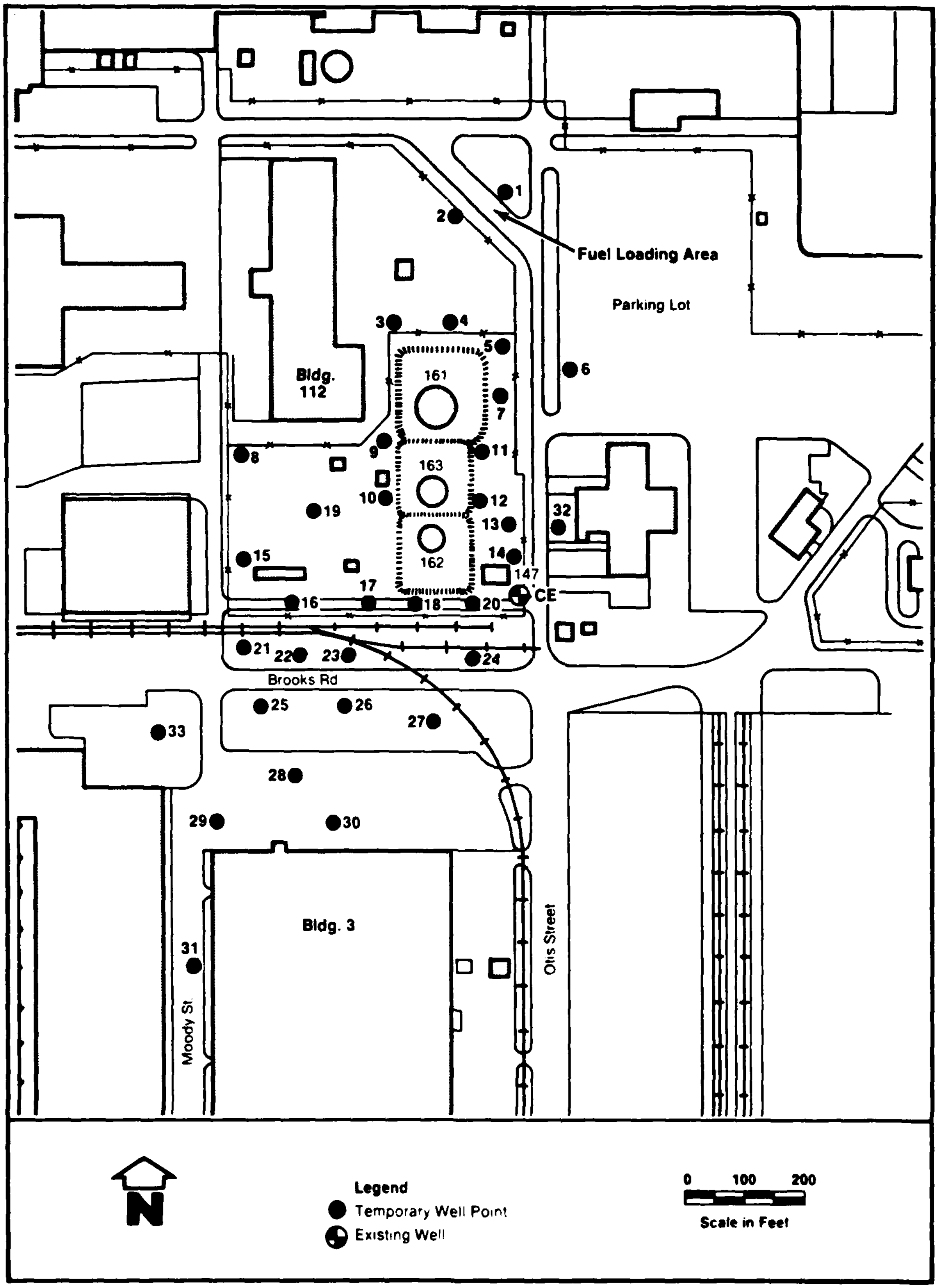


FIGURE 3-2 LOCATION OF TEST BORINGS AND TEMPORARY WELL POINTS AT THE TANK FARM AREA

Soil borings encountered permeable sands and gravels, with the water table occurring at 8 to 14 feet. As the well points were installed, the ground water survey was started, which included determining the top of casing elevations and measuring depth to ground water. Ground water levels stabilized rapidly due to the permeable sediments. It became evident that the general direction of ground water flow was to the southwest. The distribution of well points was, therefore, skewed to the southwest of the Tank Farm in order to sample the down gradient area.

The well points were allowed to stabilize for at least 24 hours before water level measurements were made. In addition, any visible presence or measurable thickness of fuel product in the water column was noted and an explosimeter reading taken at the top of the PVC pipe. The results of three rounds of water level measurements are summarized in Table 3-3. On 10 July 1984, a bottom entry glass bailer was used to measure floating fuel product thickness on the water surface. These results are also presented in Table 3-3. Since the well points were not developed, these measurements are only a rough indication of fuel product presence in the ground water. Figure 3-3 presents a ground water surface map of the Tank Farm area, based on well point elevations. Areas of fuel product occurrence on the water table are shown, along with explosimeter readings for fuel vapors for completed borings showing no visible fuel in the ground-water surface. The latter provides a qualitative indication of the presence of fuel product in the subsoil.

Based on the information obtained by the temporary well points, permanent ground water monitoring wells were installed around the site. The original task order called for placing six wells at the Tank Farm site. However, it was WESTON's opinion, after installing the well points, that additional wells would be necessary at the Tank Farm. At the same time, no free fuel was encountered in the soil borings or well points at Building 210, and it was felt that the four permanent wells planned for that area could be reduced to two wells. (Building 210 is discussed in Section 3.1.7.) After consultation with USAF OEHL and SAC, WESTON located two additional wells in the Tank Farm area and deleted two wells in the Building 210 area. The eight permanent wells placed in the Tank Farm area are shown on Figure 3-4. Wells MW-21 and MW-22 were located a few feet to the north of the steam-line trench where fuel contamination was originally observed, between the trench line and the Tank Farm (At the time of WESTON's investigation, the lines were in place and the trench was covered). Wells MW-23 and MW-24 were located downgradient

TABLE 3-3

Well Point Survey and Groundwater Elevation Data
Tank Farm and Building 210

Well Point Number	Top of PVC Elevation (Ft.)	Depth to Water (Ft.)			Groundwater Elevation (Ft.)			Explosimeter Reading (%)	Fuel Product Thickness (In.)
		7/10	7/16	8/4	7/10	7/16	8/4		
TB-1	470.54	11.82	--	--	458.72	Monitor Well		9	ND
TB-2	469.71	10.94	11.15	12.64	458.77	458.56	457.07	3	ND
TB-3	472.13	13.32	13.47	12.98	458.81	458.66	459.15	0	ND
TB-4	470.89	12.23	12.44	12.97	458.66	458.45	457.92	0	ND
TB-5	470.13	11.47	11.71	12.21	458.66	458.42	457.92	0	ND
TB-6	468.10	11.46	11.71	12.21	456.64	456.39	455.89	3	ND
TB-7	470.25	11.78	12.03	12.56	458.47	458.22	457.69	0	ND
TB-8	469.73	11.11	11.25	11.76	458.62	458.48	457.97	4	ND
TB-9	472.39	13.82	14.03	14.16	458.57	458.36	458.23	0	ND
TB-10	472.81	13.47	--	14.29	459.34	--	458.52	0	ND
TB-11	470.91	12.44	12.69	13.23	458.47	458.22	457.68	0	ND
TB-12	470.30	11.93	12.20	--	458.37	458.10	--	o	ND
TB-13	468.85	10.84	11.19	11.93	458.01	457.66	456.92	80	4.5
TB-14	468.27	10.87	11.28	11.46	457.40	456.99	456.81	62	Trace
TB-15	469.04	11.54	11.83	12.14	457.50	457.21	456.90	4	ND
TB-16	471.23	14.20	14.82	14.82	457.03	456.41	456.41	55	5.0
TB-17						Monitor Well		40	0.12
TB-18	472.55	15.49	15.54	16.05	457.06	457.01	456.50	40	ND
TB-19	470.64	13.22	13.41	13.97	457.42	457.23	456.67	6	ND
TB-20	469.58	12.57	13.00	13.22	457.01	456.58	456.36	76	Trace
TB-21	468.53	12.22	--	--	456.31	Monitor Well		16	ND
TB-22	468.77	12.55	13.10	12.87	456.22	455.67	455.90	18	ND

ND Not Detected

TABLE 3-3 (Cont.)

Well Point Number	Top of PVC Elevation* (Ft.)	Depth to Water (Ft.)			Groundwater Elevation (Ft.)			Explosimer Reading (%)	Fuel Product Thickness (In.)
		7/10	7/16	8/4	7/10	7/16	8/4		
TB-23	468.72	12.51	12.97	13.24	456.21	455.75	455.48	56	1.5
TB-24	467.84	11.79	12.27	12.26	456.05	455.57	455.58	44	0.10
TB-25	467.87	12.55	--	--	455.32	Monitor Well		24	ND
TB-26	468.62	12.35	--	--	456.27	Monitor Well		4	ND
TB-27	467.36	11.25	11.79	11.35	456.11	455.57	456.01	0	ND
TB-28	467.78	12.15	12.79	14.45	455.63	454.99	453.33	0	0.85
TB-29	466.74	11.68	--	--	455.06	Monitor Well		2	ND
TB-30	468.66	12.69	13.27	12.67	455.97	455.39	455.99	2	ND
TB-31	466.78	11.56	12.04	11.43	455.32	454.84	455.45	0	ND
TB-32		11.60	--	12.16					
TB-33	466.51	11.16	11.66	10.85	455.35	454.85	455.66	52	0.90
TB-34	478.44	21.23	21.30	Monitor Well	457.21	457.14	Monitor Well	0	ND
TB-35	474.60	17.07	17.16	17.59	457.53	457.44	457.01	0	ND
TB-36	474.45	17.08	17.15	17.50	457.37	457.30	456.95	0	ND
TB-37	477.99	20.65	20.73	21.01	457.34	457.26	456.98	0	ND
TB-38	475.91	18.82	18.92	19.19	457.09	456.99	456.72	0	ND
TB-39	474.96	17.59	--	19.06	457.37	--	455.90	0	ND
TB-40	478.14	20.83	20.91	21.23	457.31	457.23	456.91	0	ND

ND = Not Detected

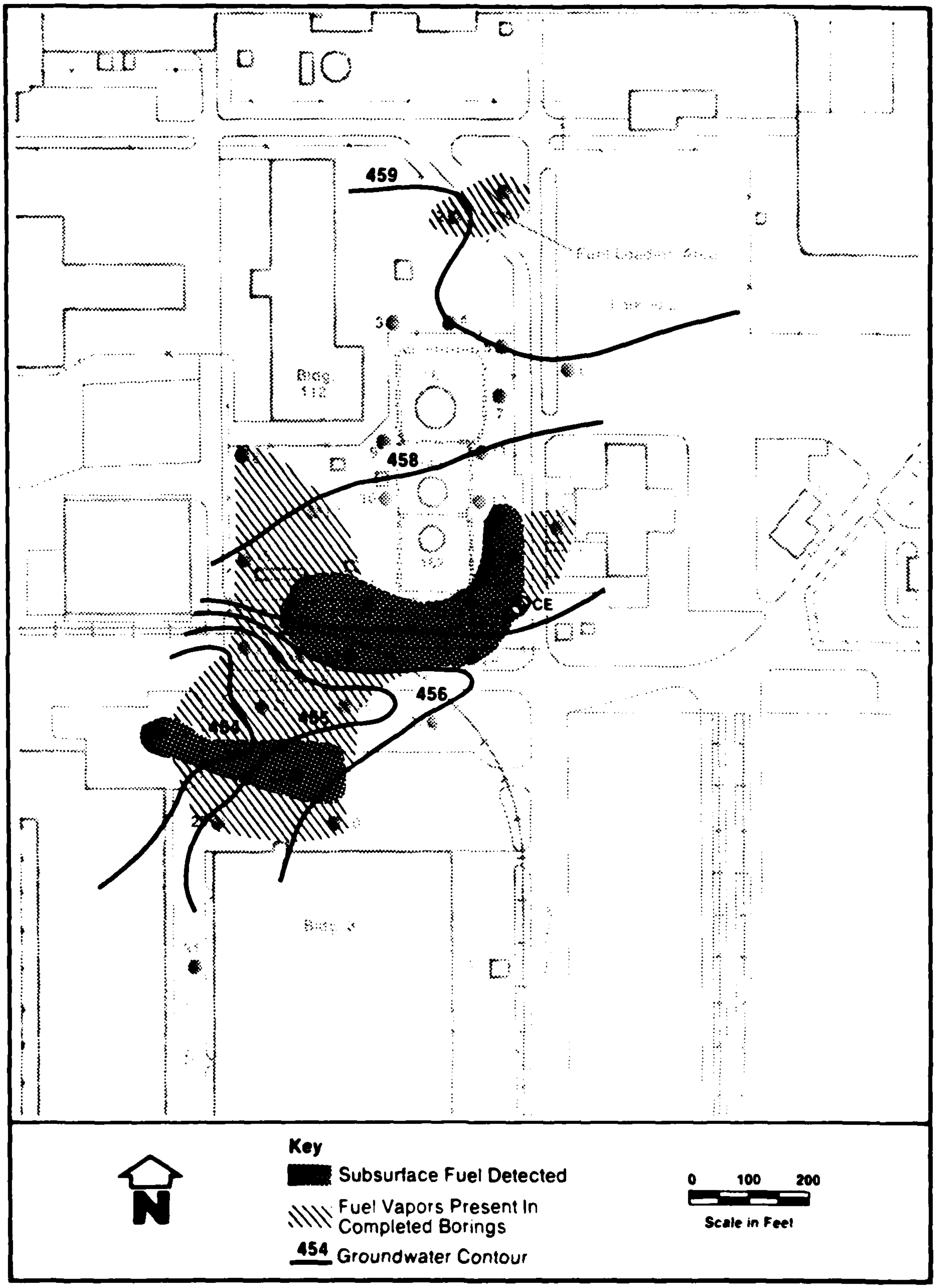


FIGURE 3-3 SUBSURFACE FUEL DISTRIBUTION AND GROUNDWATER SURFACE CONTOURS BASED ON WELL POINT SURVEY AT TANK FARM

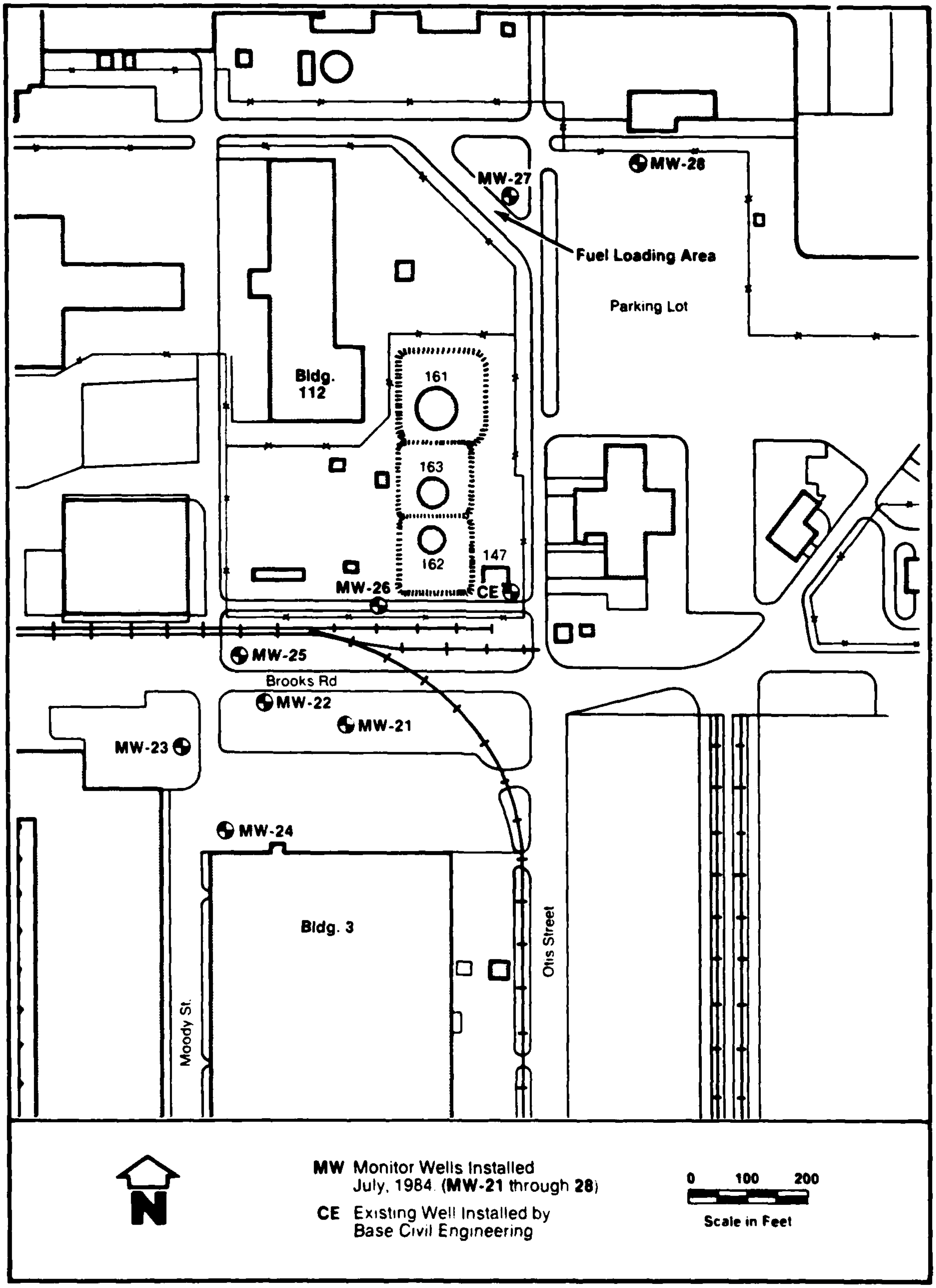


FIGURE 3-4 LOCATION OF MONITORING WELLS, TANK FARM AREA

of any visible or vapor contamination detected during the boring survey. MW-26 is located on the south edge of the buried tank area, downgradient from that area and upgradient from the railroad loading docks. MW-27 was located in the truck loading dock area, north of the Tank Farm, where some soil contamination was observed in the initial soil borings. MW-28 is located upgradient from the entire investigation area. Also noted on Figure 3-4 is a monitoring well installed by the Base Civil Engineering Department (designated CE in this report). Located in the southeast corner of the Tank Farm, this well is not directly downgradient but is in close enough proximity to monitor possible contaminant dispersal from the soil near Building 147. Floating fuel product has been observed on this well in the past, although none was found during this study.

As discussed in Section 3.1.2, wells were constructed of slotted 4-inch diameter PVC pipe. All eight wells in the Tank Farm area were 25 feet deep, screened from 5 to 25 feet in permeable sands and gravels. The water table was encountered at depths of approximately 8 to 14 feet. Table 3-4 and Figure 3-5 present a summary of well construction, elevations and sediment descriptions. Complete boring and well construction logs are in Appendix D.

3.1.7 Building 210

A total of 7 soil borings were completed and ground water monitoring points were installed in the area around Building 210. The well point locations are shown on Figure 3-6. Boring logs are included in Appendix D. The boring and well point locations were clustered around the location of the buried tank with boring TB-39 only a few feet away from the tank site. The procedures followed for soil borings, well point installation and the ground water survey were identical to those used at the Tank Farm and described in Section 3.1.3.

The soil borings encountered permeable sands and gravels with the water table located approximately 18 feet below ground surface. Groundwater flow is towards the southwest, as shown on the ground water surface contour map (Figure 3-7). No fuel contamination was visible in the soils or on the ground water surface.

Based on the above findings, WESTON recommended that the proposed four permanent wells be reduced to two. As

TABLE 3 - 4

SUMMARY OF WELL CONSTRUCTION DETAILS

Monitor Well Number	Approximate Land Surface Elevation in Ft.	Top of PVC Elevation (Feet)	Screened Interval Depth (Feet)	Depth to Water In Feet (8/28/84)	Elevation of Ground Water In Feet (8/28/84)
TANK FARM					
MW-21	466.3	471.01	5-25	14.56	456.45
MW-22	467.7	470.02	5-25	13.66	456.36
MW-23	467.2	466.51	5-25	10.22	456.29
MW-24	466.7	466.71	5-25	10.49	456.22
MW-25	468.3	470.53	5-25	14.09	456.44
MW-26	472.1	472.02	5-25	15.19	456.83
MW-27	470.2	472.36	5-25	14.32	458.04
MW-28	470.7	470.26	5-25	12.30	457.96
LANDFILL 7					
MW-15	508.9	510.85	4.5-19.5	9.50	501.4
MW-16	516.2	518.49	8 -23	14.94	503.6
MW-17	518.3	520.17	20 -35	28.11	492.0
MW-18	507.7	510.35	10.5-25.5	14.56	495.8
MW-3	518.3	520.03	22 - 32	17.73	502.3
BUILDING 210					
MW-19	475.0	476.42	10-30	19.9	456.5
MW-20	474.0	475.97	10-30	19.3	456.6

SEDIMENT DESCRIPTION IN SCREENED ZONE

TANK FARM

MW-21	Brown interbedded sandy silt and sandy gravel.
MW-22	Brown fine-coarse SAND, some gravel. Fuel staining and odor.
MW-23	Brown fine to coarse SAND and fine to coarse gravel.
MW-24	Brown fine to coarse SAND, interbeds containing gravel and silt.
MW-25	Brown fine SAND grading with depth to medium to coarse SAND and gravelly SAND.
MW-26	Brown-grey fine to coarse SAND, a little gravel and silt.
MW-27	Brown fine to coarse SAND and GRAVEL - Dense clay till at base of boring (20-25 feet)
MW-28	Brown fine - coarse SAND and GRAVEL.

LANDFILL 7

MW-15	Light brown fine to medium SAND, dense grey clay till at base of boring (20 feet)
MW-16	Black granular fill to 7' overlying brown fine to medium SAND. Dense clay till at base of boring (24 feet).
MW-17	Brown medium SAND grading with depth to fine-medium sand and silty SAND. Dense clay till at base of boring (35 feet).
MW-18	Brown fine SAND. Dense clay till at base of boring (25 feet).
MW-3	Brown fine to medium SAND.

BUILDING 210

MW-19	Brown fine to coarse SAND, some silt and medium gravel. Firm grey clayey silt at 30 feet.
MW-20	Brown fine to coarse SAND, some gravel, a little silt. Firm grey clayey silt at 25-30 feet.

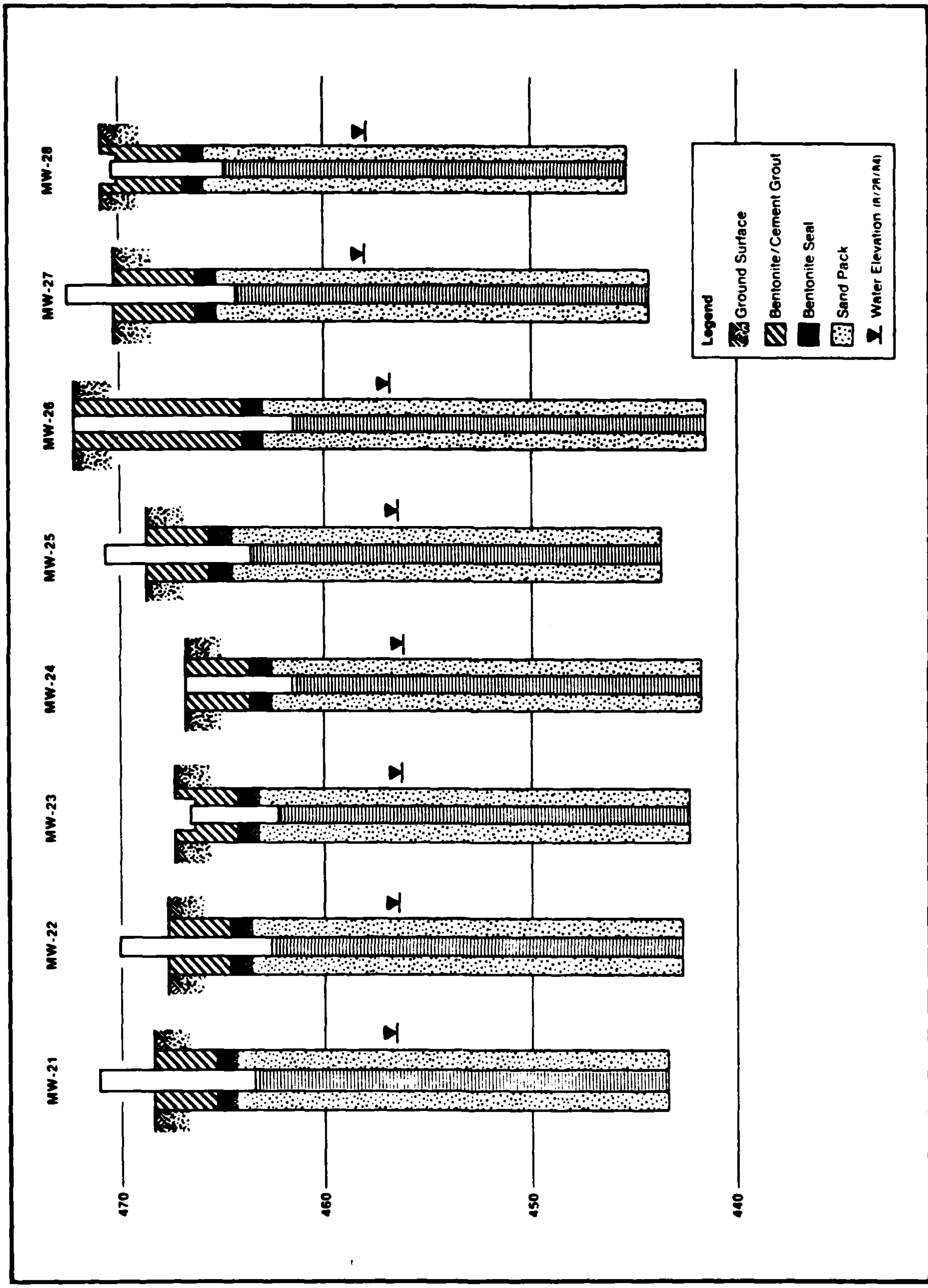


FIGURE 3-5 WELL COMPLETION DIAGRAM FOR PHASE II MONITOR WELLS AT GRIFFISS AIR FORCE BASE - TANK FARM AREA

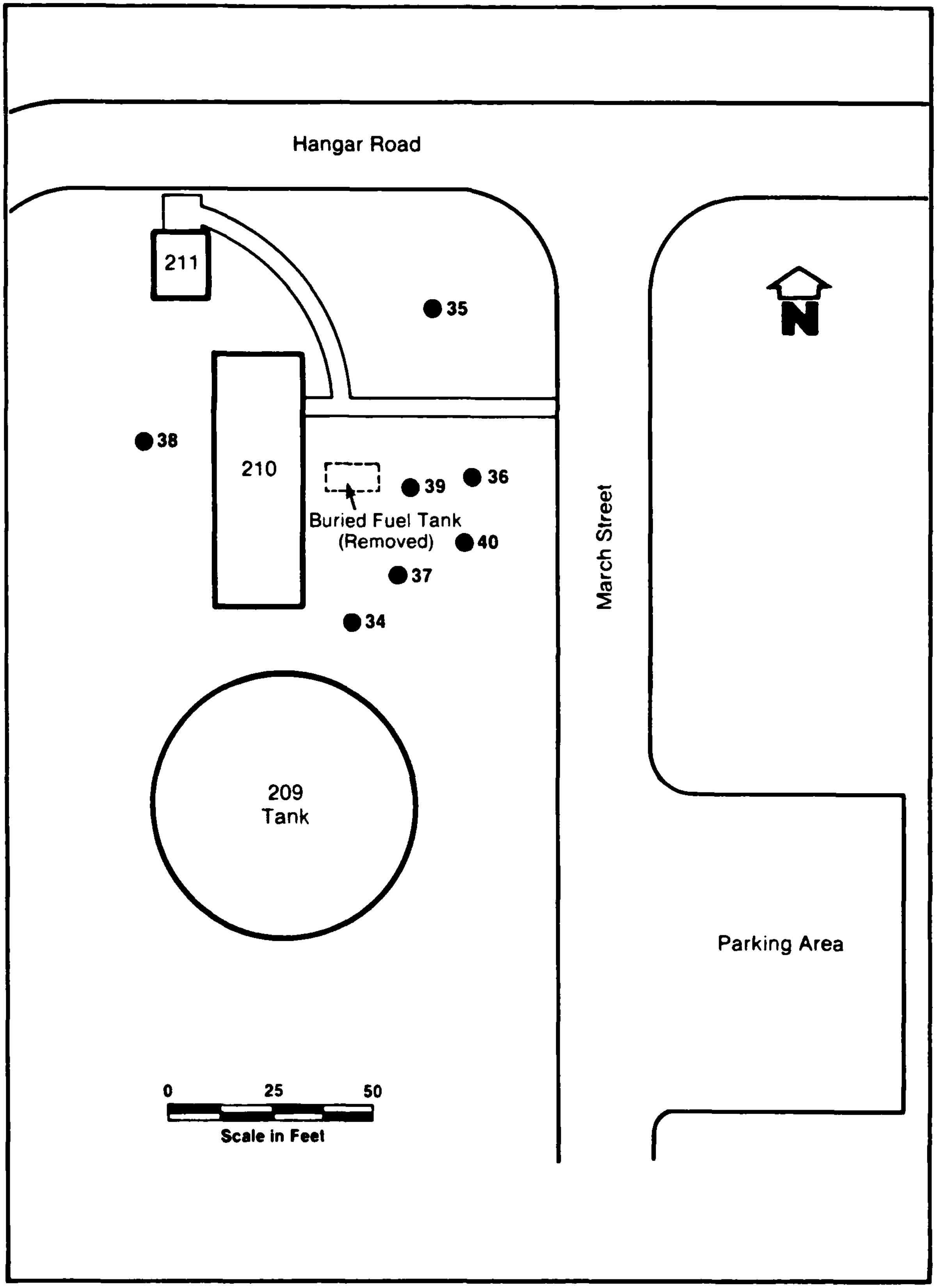


FIGURE 3-6 LOCATION OF TEST BORINGS AND TEMPORARY WELL POINTS AT BUILDING 210

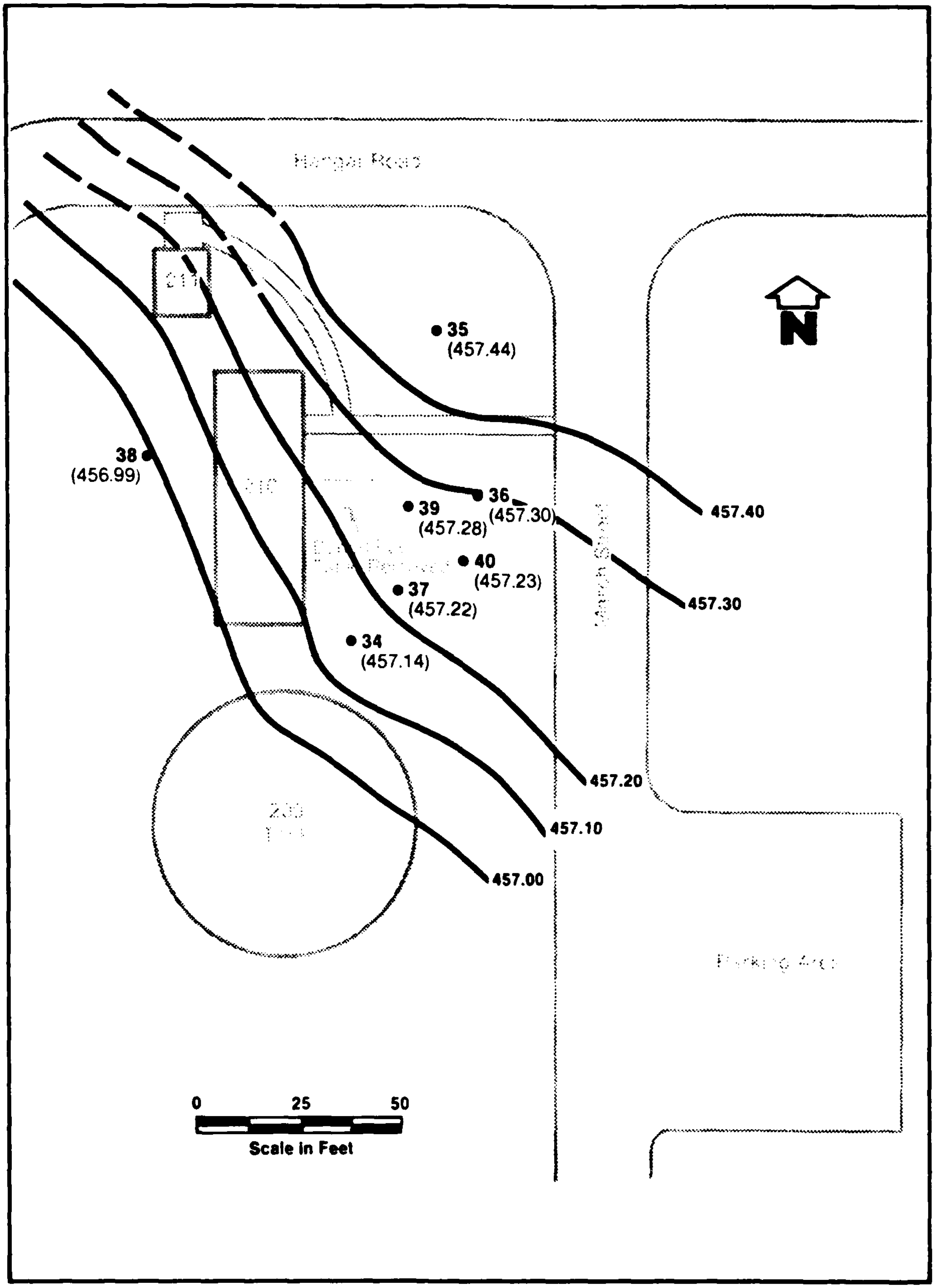


FIGURE 3-7 GROUNDWATER SURFACE CONTOURS BASED ON WELL POINT SURVEY - BUILDING 210

discussed in Section 3.1.3., with the approval of USAF OEHL and SAC, only two wells were installed at Building 210 and two wells were added to the Tank Farm network. Both wells were placed near the buried tank location at Building 210, shown in Figure 3-8. Locations of the wells were limited by the building and buried utilities. While not strictly downgradient of the tank as defined by the flow map in Figure 3.7, the very low gradients would allow broad dispersion of any fuel product leaking to the water table and would be observed in nearby wells. MW-20 is within 10 feet of the buried tank. The wells MW-19 and MW-20 were located at existing boring locations TB-34 and TB-39, respectively. Both wells were constructed in a manner described in Section 3.1.2. They are both 30 feet deep and screened from 10 to 30 feet. The water table is located approximately 18 feet below the ground surface. Both wells are screened in permeable sands and gravels with some silts. MW-20 encountered a low permeable clayey silt from 25 to 30 feet. Well construction details are summarized in Table 3-4 and Figure 3-9.

3.1.8 Landfill #7

Four monitoring wells were installed at Landfill 7 at the locations shown in Figure 3-10, to characterize the leachate being generated at the site and assess its impact on ground water quality. The landfill is located on a topographic high and probable mounding of the water table in this area makes it difficult to determine upgradient and down gradient ground water flow directions before drilling. The four monitoring well locations were selected to give the best possible coverage at the landfill and to determine flow directions and hydraulic gradients. The borings encountered a uniform medium sand, to depths of between 19.5 and 35 feet below ground surface. The sand overlies a compact clayey glacial till, which acts as a relatively impermeable hydraulic barrier beneath the relatively permeable sands. A fifteen-foot section of screen was placed in each well intercepting the entire saturated sand zone. The final depth of each well was determined by the depth to the confining layer of glacial till.

Monitoring well MW-15 was installed upslope and slightly upgradient from the seep area in which the leachate displayed an oily film. This well extends 19.5 feet into fine sand before reaching the till. The screened interval is 4.5 - 19.5 feet below grade, with the water level at the depth of 6.5 feet below the surface. Monitoring wells MW-17

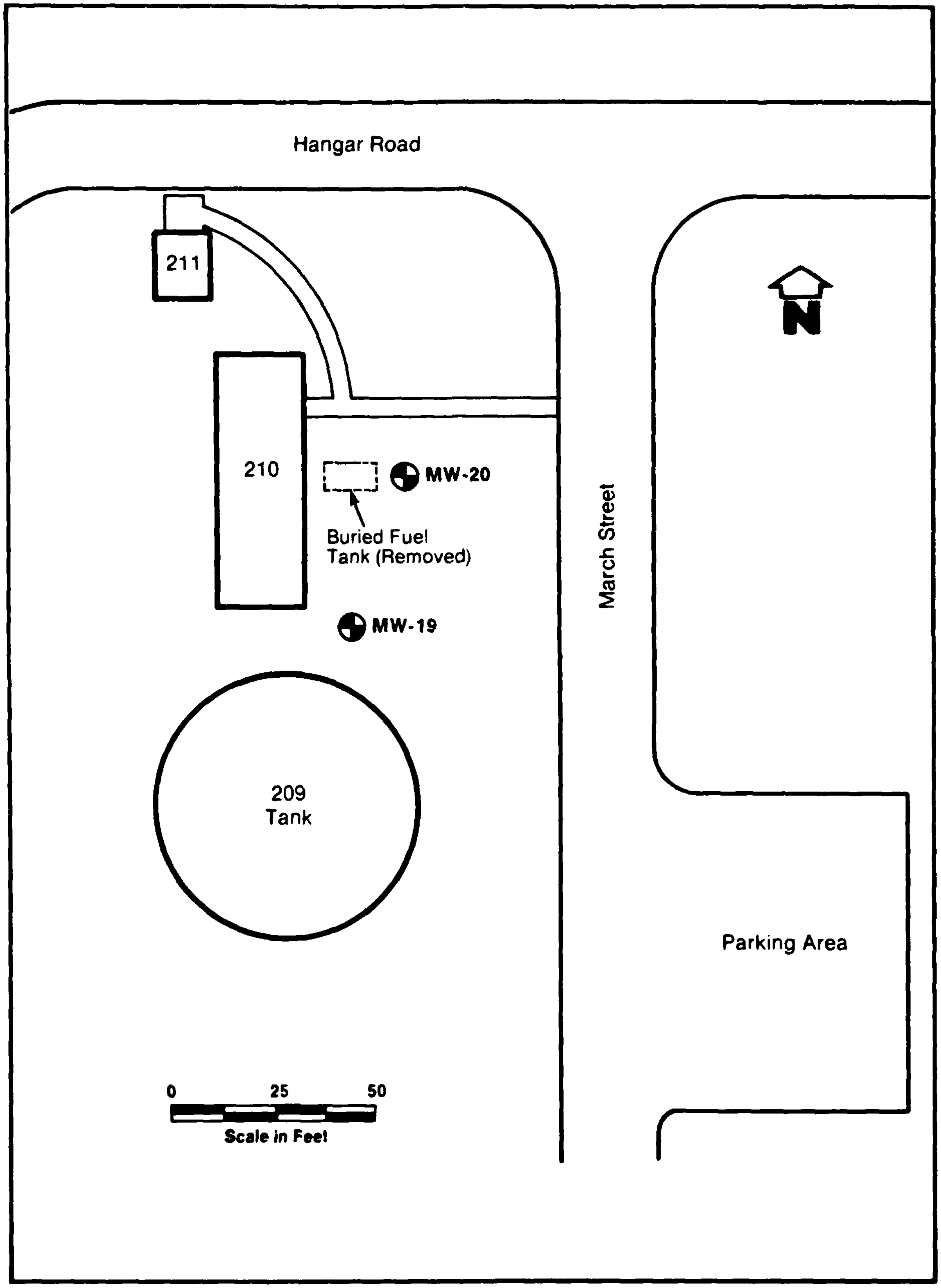


FIGURE 3-8 LOCATION OF MONITORING WELLS - BUILDING 210

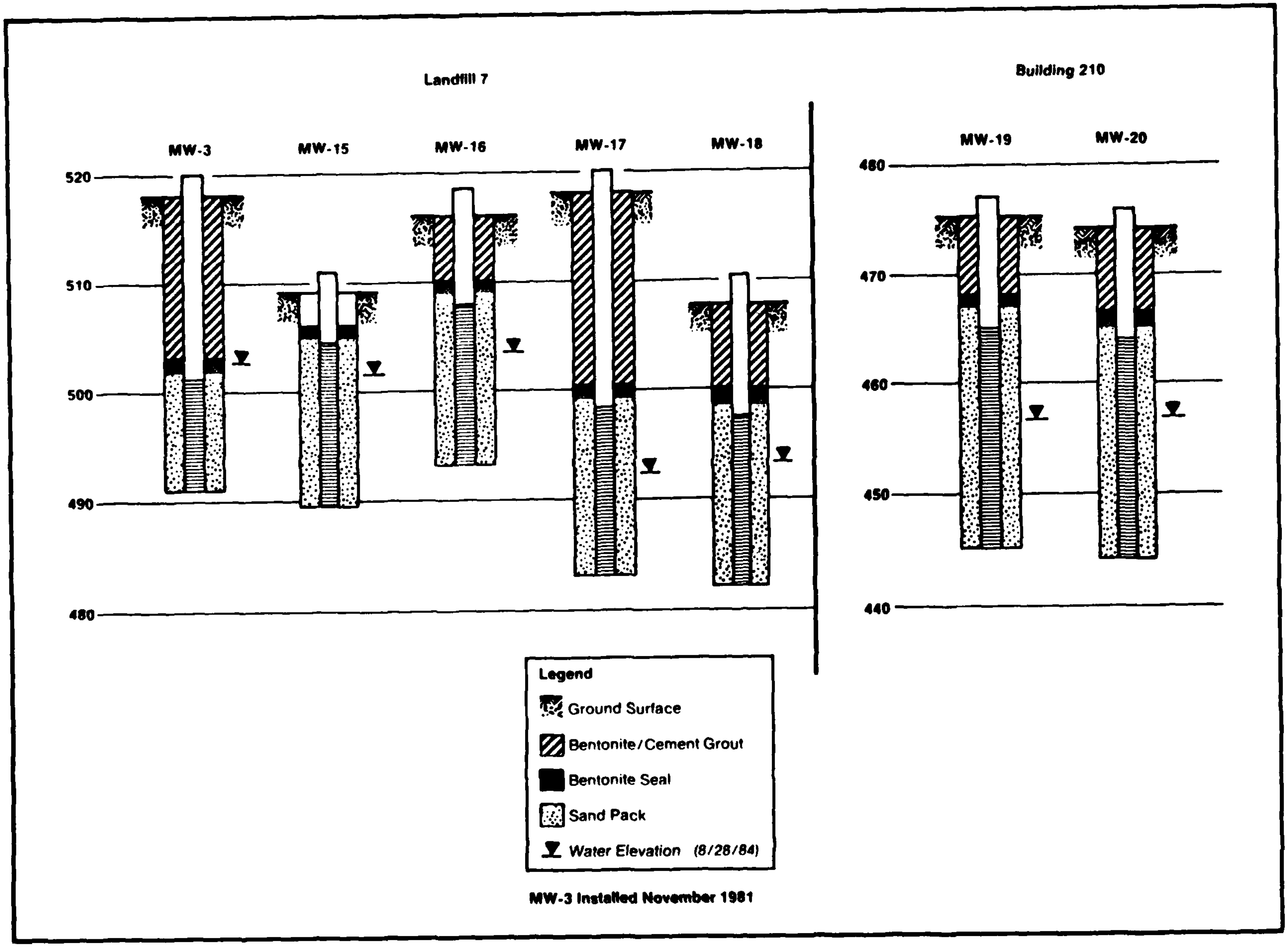


FIGURE 3-9 WELL COMPLETION DIAGRAM FOR PHASE II MONITOR WELLS AT GRIFFISS AIR FORCE BASE - BUILDING 210 AND LANDFILL 7

WESTON

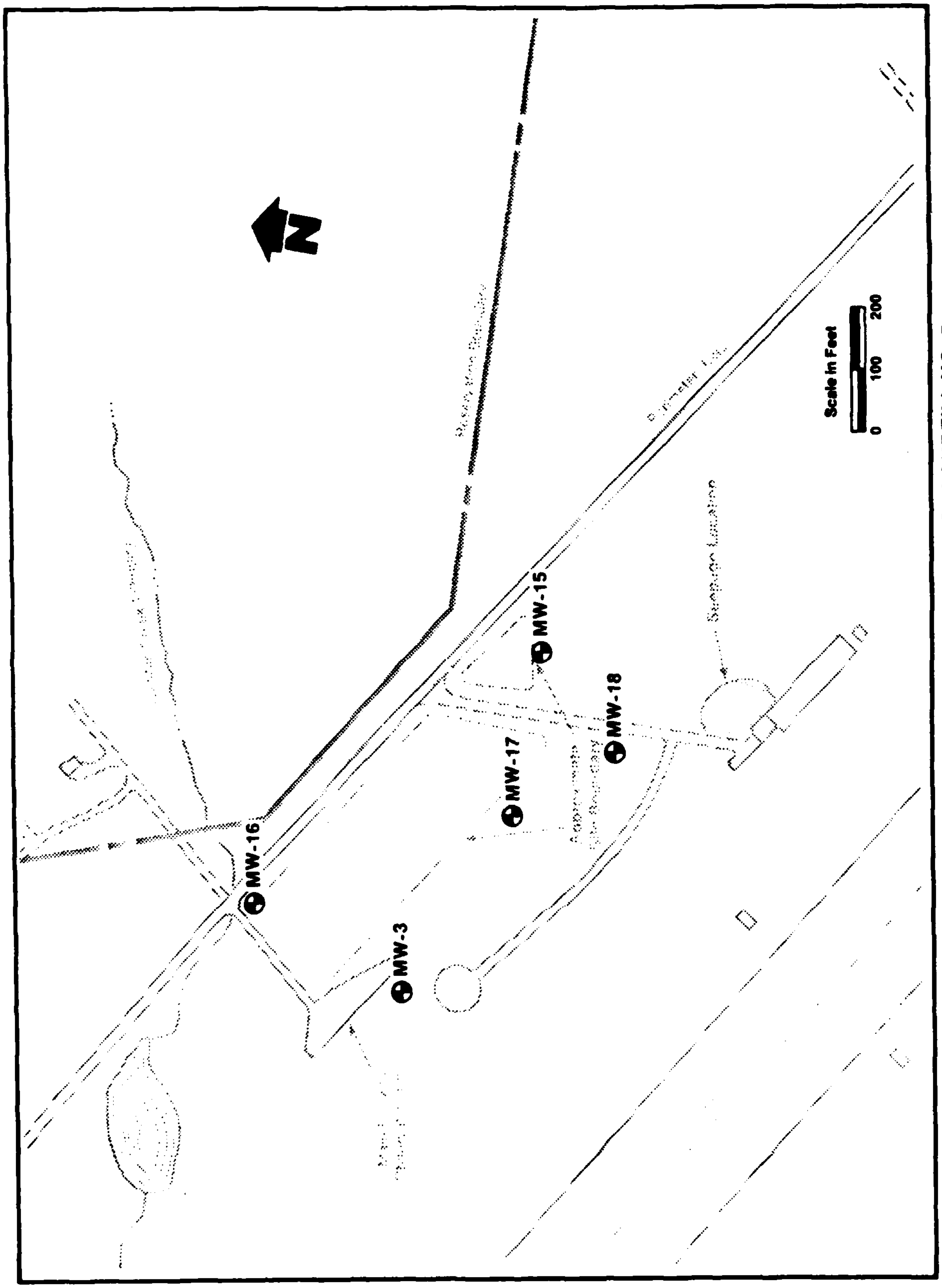


FIGURE 3-10 LOCATION OF MONITORING WELLS - LANDFILL NO. 7

and MW-18 were installed on the south edge of the central part of the old landfill. Monitor well MW-18 extends 25.5 feet through uniform fine sand, with a screened interval from 10.5 - 25.5 feet below grade. The water level is about 12 feet below grade. Monitor well MW-17 was installed slightly downgradient from the topographic high of the landfill. It extends through 35 feet of medium to fine sand over fine sand and silt before reaching the grey, clayey till. This well is screened from 20-35 feet below grade, and the water table is 24.5 feet below the ground surface.

Monitoring well MW-16 is located on the perimeter of the landfill in the northern corner. It extends to a depth of 23 feet. The top 8 feet of the well penetrates blackened silt and gravel, charred organic material, and traces of solid refuse such as glass and brick fragments, which are probably remains of the burned fill. The well then penetrates fine sands and silts and terminates atop the deposit of glacial till. The 15-foot screen is present in the interval from 8 to 23 feet below grade. Well construction details are presented in Table 3-4 and Figure 3-9. Drilling logs and well construction logs are included in Appendix D.

3.1.9 BATTERY ACID DISPOSAL PITS

Two Battery Acid Disposal Pits, located in Buildings 101 and 222, were sampled to determine the extent of heavy metal contamination. Upon obtaining access to each pit and removing the covering grate, the battery sludge and underlying soils were sampled. Samples were taken by driving a 2-inch outside diameter split-spoon sampler into the sludge, in accordance with Standard Penetration Test Methods (ASTM-D-1586). The sludge in both pits was firm and somewhat moist, allowing the holes to stay open without casing. The underling soil was sampled at 2 foot intervals to a depth at which the soil sample no longer had visible sludge contamination. The split spoon sampler was decontaminated with Alconox and a deionized water rinse between each sampling interval to prevent cross-contamination of samples.

All samples were logged by a WESTON soil scientist who recorded information on soil description, penetration resistance to the sampler (blow counts), sample depth and other relevant information. The boring logs are presented in Appendix D of this report. Representative soil samples from each sampling interval were preserved in glass jars and

returned to the laboratory for chemical analyses. At the completion of the soil borings, any excess soil from the pit was returned to the pit and the grate was replaced. The concrete pavement surrounding each Battery Acid Disposal Pit was washed down with water.

The Battery Acid Disposal Pit inside Building 101, designated BP-1, was located in the battery maintenance shop, which did not allow access by the drill rig. Therefore, the hole was made with a tripod-mounted manually driven cathead. In this pit, samples were taken at 0-2 feet, 2-4 feet, 4-6 feet and 6-8 feet and were labeled 101-1 through 101-4 respectively. Visual inspection indicated that the sludge terminated at approximately 6 feet. One further sample was taken from 6-8 feet to be sure the underlying sediments did not contain visible sludge. This last sample was also submitted for chemical analyses.

The Battery Acid Disposal Pit inside Building 222, BP-2, was located in a truck bay which allowed access for the drill rig. The CME-45C skid rig was utilized for this boring, and samples were taken with the split-spoon sampler in the manner previously described. In this pit, samples were taken at 0-2 feet, 2-4 feet, 4-6 feet, 6-8 feet, 8-10 feet and 10-12 feet, and were labelled 222-1 through 222-6 respectively. Visual inspection of the samples indicated that this Battery Acid Disposal Pit contained sludge to the depth of 10 feet. One further sample was taken from 10-12 feet to obtain a sample of the underlying sediments. Figure 3-11 shows both Battery Acid Disposal Pits and the depths to sludge.

3.2 AQUIFER TESTING

During the pumping of monitoring wells prior to sampling, pumping rates, water level drawdown and recovery were measured periodically. Sufficient data was gathered at wells to estimate aquifer transmissivities based on the Cooper-Jacobs method where:

$$T = \frac{2.3Q}{4\pi\Delta S}$$

T = transmissivity

Q = pumping rate

S = Change in drawdown per log cycle of time.

Transmissivity is defined as the rate of flow through a unit thickness of aquifer under a hydraulic gradient of one. The

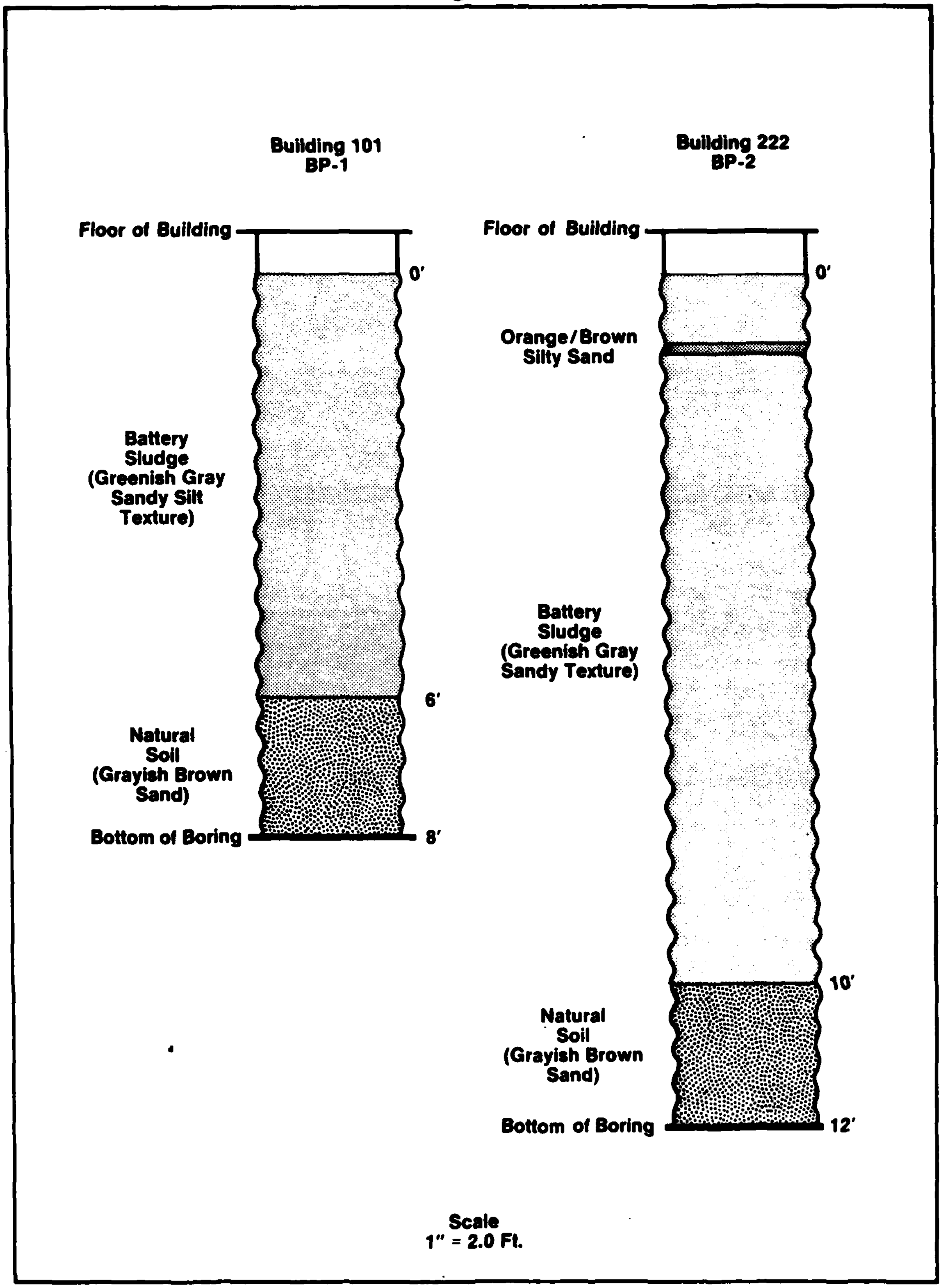


FIGURE 3-11 BATTERY ACID PIT DRY WELLS

pumping well also served as the observation well. Hydraulic conductivity is defined as the rate of flow through a unit area of aquifer under a hydraulic gradient of one. To calculate hydraulic conductivity, the transmissivity is divided by the aquifer thickness, which in this case was assumed to be the thickness of the penetration of the well to the low permeability till which was encountered in a number of wells.

In these short duration pumping tests the observation wells were the pumping wells themselves and the range of influence did not extend more than a few feet beyond the well. Although this method of analysis is for confined aquifers, the results for these short duration pump test approximate unconfined conditions.

Pumping rates were less than 6 gpm and the wells were pumped until the water levels stabilized. After the pumps were shut down, water level recovery measurements were made. These recovery measurements were used for the actual drawdown versus time curves in the analyses, since well recovery mirrors drawdown and is free of well effects produced during pumping. The results of the analyses are presented in Appendix F. The significance of these results is discussed in Section 4.2.

3.3 GROUND WATER SAMPLING

3.3.1 Field Water Quality Testing

Field water quality testing was conducted at each well sampled. Specific conductance and temperature were measured in the field using a Yellow Springs Instrument Company Model 33 meter. The pH was measured in the field using an Analytical Measurement Model 107 pH meter. Field water quality testing was conducted concurrently with water quality sampling during the week of 14 August 1984. Results are shown in Table 3-5. During this time, all monitoring wells were tested for field water quality parameters.

3.3.2 Water Quality Sampling

The purpose of the water quality sampling program was to identify the location, concentration and areal extent of any contamination present in the hydrologic environment. To achieve these goals, standard field procedures were followed. Detailed descriptions of the procedures used are contained in Appendix G. The well was purged by pumping and

Table 3-5

Specific Conductance and pH of Monitoring Wells

Location	Well No.	pH	Spec. Cond. (umhos/cm)	Temp. ^{o}C
Landfill 7	MW-3	6.87	290	7
	MW-15	7.03	190.3	8
	MW-16	6.27	1222	11
	MW-17	6.49	1241	11
	MW-18	6.10	206.6	12
Bldg. 210	MW-19	7.05	416	9
	MW-20	6.80	368	9
Tank Farm	MW-21	6.63	677	11
	MW-22	6.54	708	12
	MW-23	6.85	448	16
	MW-24	6.80	638	14
	MW-25	6.38	485	9
	MW-26	7.08	568	8
	MW-27	6.50	465	14
	MW-28	6.44	350	15
	MW-CE	7.19	459	10

removing three to five times the calculated volume of standing water in the well casing. After purging the well, the pump was removed from the well and a Teflon bailer was lowered into the well and filled with water. Each sample container was gently filled from the bailer, taking care to avoid aeration and turbulence in the sample water. The pump and bailer were decontaminated in between each well by scrubbing with an Alconox solution and flushing with deionized water. The sample containers were wrapped in packing material and placed in an ice-filled thermal chest for transportation to the Laboratory.

SECTION 4

RESULTS

4.1 SITE INTERPRETIVE GEOLOGY

Based on a general review of area geology and site specific information obtained during this and the previous IRP Phase II site investigation, an overview of the site geology was obtained. Generally, the entire area is underlain directly by permeable, glacially derived sands and gravels. The majority of the monitor wells at the site are screened in these unconsolidated sediments. (Several wells installed at Landfill 1 in 1982 are screened in less permeable floodplain sediments along Six Mile Creek.) Because boring depths at the site have been limited to 35 feet or less, no specific information is available below that depth.

In the northern part of the site, the Utica shale was encountered as high as 12 feet below ground surface at Landfill 1, with its surface dipping south toward the valley axis (see WESTON, 1982 IRP Phase II, Stage 1 Report). In recent borings at Landfill 7, a clay-till was encountered below the sandy water-bearing zone. All borings completed at Landfill 7 encountered uniform sands and silty sands. Except for MW-3, this area was underlain by a dense clay till encountered at depths of 20 to 35 feet. The till is at least locally continuous, and lies probably only a few feet below ground surface in the low area where the wet area adjacent to the landfill is located.

The Tank Farm and Building 210 are located within the main Base area, where past cut-and-fill activity has produced the existing grade level. In addition to soil borings, extensive trenching recently conducted in the area for utility installation shows the site is uniformly underlain with sands and coarse gravels, with abundant sub rounded cobble size rocks (>3" diameter). A clayey silt was encountered at 25 to 30 feet in borings at Building 210 (MW-19 and MW-20) that may be lacustrine (lake bed) in origin. Clay till was encountered at one Tank Farm boring (MW-27). Depth to bedrock in this area has been estimated to be approximately 80 feet below the ground surface.

A review of the geologic data obtained during the Battery Acid Disposal Pit borings at Buildings 101 and 222 indicates there is a saturated sandy sludge present in the wells to varying depths. In the battery acid pit boring BP-1, in Building 101, the battery sludge was found to be up to 6 feet deep in a 2-foot square area, or approximately 24 $ft.^3$ of contaminated soil. The soil designated as sludge in this pit is characterized by its greenish gray color, sandy silt texture, and containing small pieces of what may be hardened carbonate. The split spoon sample taken at the depth of six to eight feet was a grayish brown silty sand, which, by visual inspection, was determined to be similar to natural soils found in the surrounding area. The boring was terminated at this point. All samples taken in this pit were described as wet, but the moisture was caused by disposal of liquids rather than the presence of the water table. The water table in this area is approximately 15 feet below ground surface.

In the Battery Acid Disposal Pit boring BP-2, in Building 222, the sludge was visually classified as being 10 feet deep, or 40 $ft.^3$ of contaminated soil with a one-inch thick band of orange brown silty sand at six inches from the top of boring. The sludge had the same characteristics as the samples taken from Battery Acid Disposal Pit BP-1. The sample taken from 10 to 12 feet below the top of the boring was a grayish brown sand, and with the visual appearance of a clean, natural soil. Figure 3-11 shows a profile of both borings. The top sample from BP-2 at 0-2 feet was wet, apparently from recent disposal of water or other liquids into the pit. The remaining profile of BP-2 was dry to damp, and the bottom of the boring at 12 feet did not encounter the water table. The water in this area is also approximately 15 feet below ground surface. The geologic logs for these borings are included in Appendix D.

4.2 SITE GROUND-WATER CONDITIONS

As evidenced by water level readings obtained from previously existing and newly installed monitoring wells, ground water occurs throughout the Base area at shallow water table conditions in the unconsolidated sands and gravelly sands tha. underlie the site. The water table occurs generally less than 20 feet below the ground surface

and is contiguous with nearby streams which receive discharge from the ground water table. Figure 4-1 presents a generalized ground water surface contour map of Griffiss AFB, based on well water level readings, and elevations of surface water on Three Mile Creek and Six Mile Creek. Although based on limited data, this map does show a gradient of flow towards the south and southwest. Recharge to the water table is primarily by percolation of direct precipitation falling on the site through the porous sandy soils that underlie the area. Recharge is reduced in the extensive paved area of the Base. In these areas surface runoff is carried directly into Three Mile and Six Mile Creeks. Ground-water discharge from the water table also occurs along Six Mile Creek, Three Mile Creek and ultimately the Mohawk River since the two smaller streams intercept the Mohawk River southeast of the Base.

Although these streams do eventually converge, they divide at the Base itself, where the Mohawk River flows south along the western edge of the Base, and the two Creeks flow southeast through the Base. A topographic high area forming the southern portion of the Base results in a physical divide. Such a physical divide also strongly implies a ground-water divide to the south of the area shown on Figure 4-1, although not enough data is available to confirm this.

Ground-water flow in the unconsolidated sediments underlying the site is also controlled by a dip in the top of the bedrock. Existing borings indicate that the Utica shale, which underlies the site, dips southerly from the northern Base boundary to the central part of the Base. Whether there is an axis of depression in the top of the bedrock conforming to the surface stream valley, or whether the dip continues to the south beyond the Base is not known. Because of the relative impermeability of the Utica shale, very little vertical flow of ground water occurs between the unconsolidated sediments and the underlying bedrock.

Table 4-1 presents a summary of well test results for analysis' of recovery of four wells including MW-15 and MW-18 at Landfill 7, and MW-23 and MW-24 at the Tank Farm. As discussed in Section 3-2, the calculated transmissivity, T, is a measure of the aquifer's ability to transmit water through a unit width under a hydraulic gradient of one. Also calculated in Table 4-1 is the hydraulic conductivity, K, which is the amount of water transmitted by a unit area

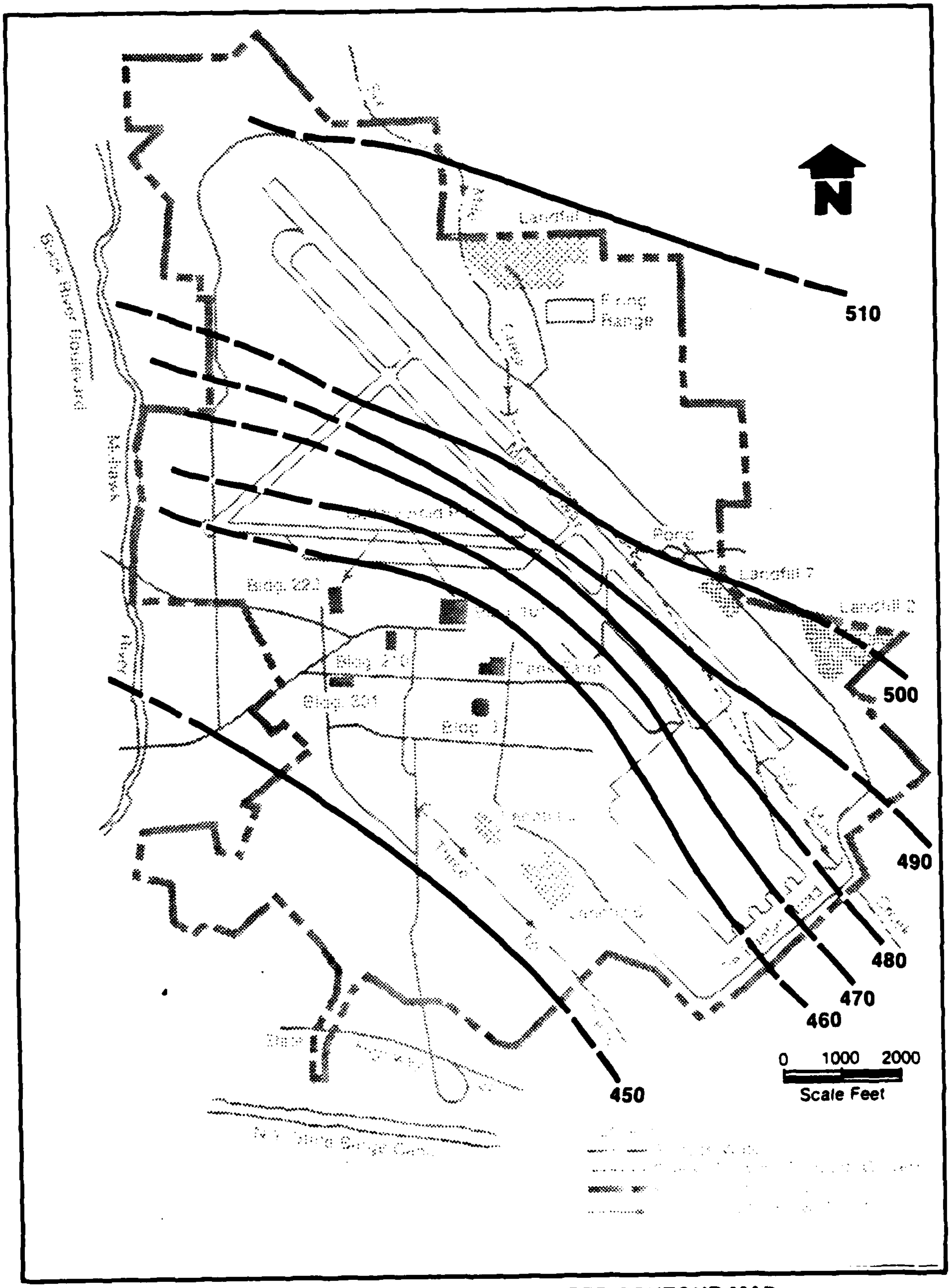


FIGURE 4-1 GENERALIZED GROUNDWATER CONTOUR MAP OF THE MAIN BASE FACILITIES AREA

WESTON

TABLE 4-1

AQUIFER TEST RESULTS

MONITOR WELL NUMBER	TRANSMISSIVITY (T) (GAL/DAY/FT)	AQUIFER THICKNESS(h)+ (FT)	CONDUCTIVITY (FT/DAY)
MW-15	371.8	10.97	4.58
MW-18	600.0	11.52	6.96
MW-23	538.8	12.85	5.61
MW-24	660.0	12.43	7.10

Sample Calculations:

*Transmissivity (T) = $\frac{264\ Q}{\Delta S}$ where Q = Pumping rate in gpm
ΔS = water level recovery in ft. over one log cycle of time (see appendix E for data)

Ref. Groundwater and Wells 1975.
Published by Johnson Division
UOP Inc., Saint Paul, MN 55165

$$\text{Conductivity (K)} = \frac{T\ (\text{gal/day/ft})}{7.48\ \text{gal/ft}^3} / h\ (\text{ft})$$

* generally expressed as: $T = \frac{2.3\ Q}{4 \pi \Delta S}$

+MW-15 and MW-18 are fully penetrating.
For MW-23 and MW-24 the aquifer thickness is assumed to be the length of the saturated screen.

of aquifer under a hydraulic gradient of one. K is equal to T/H, where "H" is the thickness of the water bearing zone.

As shown in Figure 4-1, transmissivity ranged from 372 to 660 gal/day/ft, and hydraulic conductivity from 4.6 to 7.1 feet/day in the four wells. Values for wells at the two sites overlap, and there is no real significant difference observed in transmissivities or conductivities for the Landfill or Tank Farm sites. Although this method of analysis makes simplifying assumptions, the results provide a useful approximation of aquifer transmissivity. The range of values is typical for moderately permeable sandy sediments, and several orders of magnitude higher than conductivities of the underlying tills or shale bedrock.

Groundwater flow is controlled by the hydraulic conductivity of the sediments and the hydraulic gradient at the site. Direction and velocity of ground water flow is discussed on a site by site basis in the following paragraphs.

4.2.1 Tank Farm Area Ground-Water Flow

As established during the well point survey, the direction of ground-water flow is to the southwest, perpendicular to the contours in the direction of lowering head (surface elevation), as shown in Figure 3-3. The horizontal gradient of flow is equal to the drop in head along any given flow line, divided by the length of the flow line, that is the distance of travel. This is expressed mathematically as:

$$i = \frac{\Delta h}{L}$$

where: i = hydraulic gradient
Δh = change in head
L = length of flow

h and L are expressed in units of length, such as feet, so that i is dimensionless.

The velocity of ground-water flow (seepage velocity, v) can be determined as a function of hydraulic gradient i, established on the ground-water elevation survey, and the hydraulic conductivity k, as established by the pumping tests discussed in Section 3.2. This relationship is expressed as:

$$v = \frac{Ki}{n}$$

where v, K and i are defined above and n = porosity of the sediments.

An average hydraulic conductivity from the two Tank Farm well tests provides a value of K = 6.4 ft/day. Using an estimated porosity of 0.3 and an average gradient of .0013[1], then:

$$v = 6.4\ \frac{\text{ft.}}{\text{day}} \times \frac{.0013}{.3} = .028\ \frac{\text{ft.}}{\text{day}}$$

$$v = .028\ \frac{\text{ft.}}{\text{day}} = 10.1\ \frac{\text{ft.}}{\text{year}}$$

This is a relatively low seepage velocity, given the highly permeable sediments. The low velocity is probably an effect of a shallow hydraulic gradient, which reflects the lower recharge in the heavily built up and paved area where the Tank Farm is located.

4.2.2 Building 210 Ground-Water Flow

Building 210 is located to the northwest of the Tank Farm and in the same central facilities area of the Base. Figure 3-7 presents a ground water contour map of the site based on the well point survey. The direction of ground water flow is to the southwest, the same as the Tank Farm area, and the hydraulic gradient of .001 is similar to the tank farm area. Since the sediments encountered at Building 210 are similar to those at the Tank Farm, a similar hydraulic conductivity can also be expected. Therefore, the seepage velocity equals:

$$v = \frac{6.4 \text{ ft.}}{\text{day}} \times \frac{.001}{.3} = \frac{.021 \text{ ft.}}{\text{day}}$$

$$v = \frac{.021 \text{ ft.}}{\text{day}} = \frac{7.8 \text{ ft.}}{\text{year}}$$

This is essentially the same as the seepage velocity in the Tank Farm area, and is expected since recharge conditions and sediments are similar.

4.2.3 Landfill 7

Figure 4-2 presents a ground-water surface contour map of the Landfill 7 area, based on water surface elevations in the five monitoring wells at the site. The overall direction of flow is toward the southwest, just as the previous sites discussed. Based on the two pump tests performed at the landfill, the hydraulic conductivity of the sandy sediments underlying the site is similar to the Tank Farm areas. (5.8 ft/day based on the average of two tests discussed in Sections 3.2 and 4.2.) The hydraulic gradient of .05, however, is relatively steep. The ground water surface contours in Figure 4-2 also show a distinct mounding effect in the landfill which, together with the steeper hydraulic gradient, indicates an area of recharge.

As discussed in Section 4-1, there is a clay till underlying the sandy sediments which limits vertical ground water movement. The seepage zone located in the southeast corner of the site is continuous with the water table surface which intercepts the land surface at this topographic low.

Because none of the well borings penetrated a waste cell, it cannot be determined whether the trenches intercept the water table. However, it is clear that the sandy-soil cover allows percolation of direct precipitation through the waste material to the water table. This percolation would carry any dissolved contaminants with it. Judging from the lack of waste material found in borings for MW-15 and MW-18, the observed wet area downgradient of those wells is not leachate flowing directly from the waste but is ground water seepage that has been contaminated by leachate percolation through the landfill.

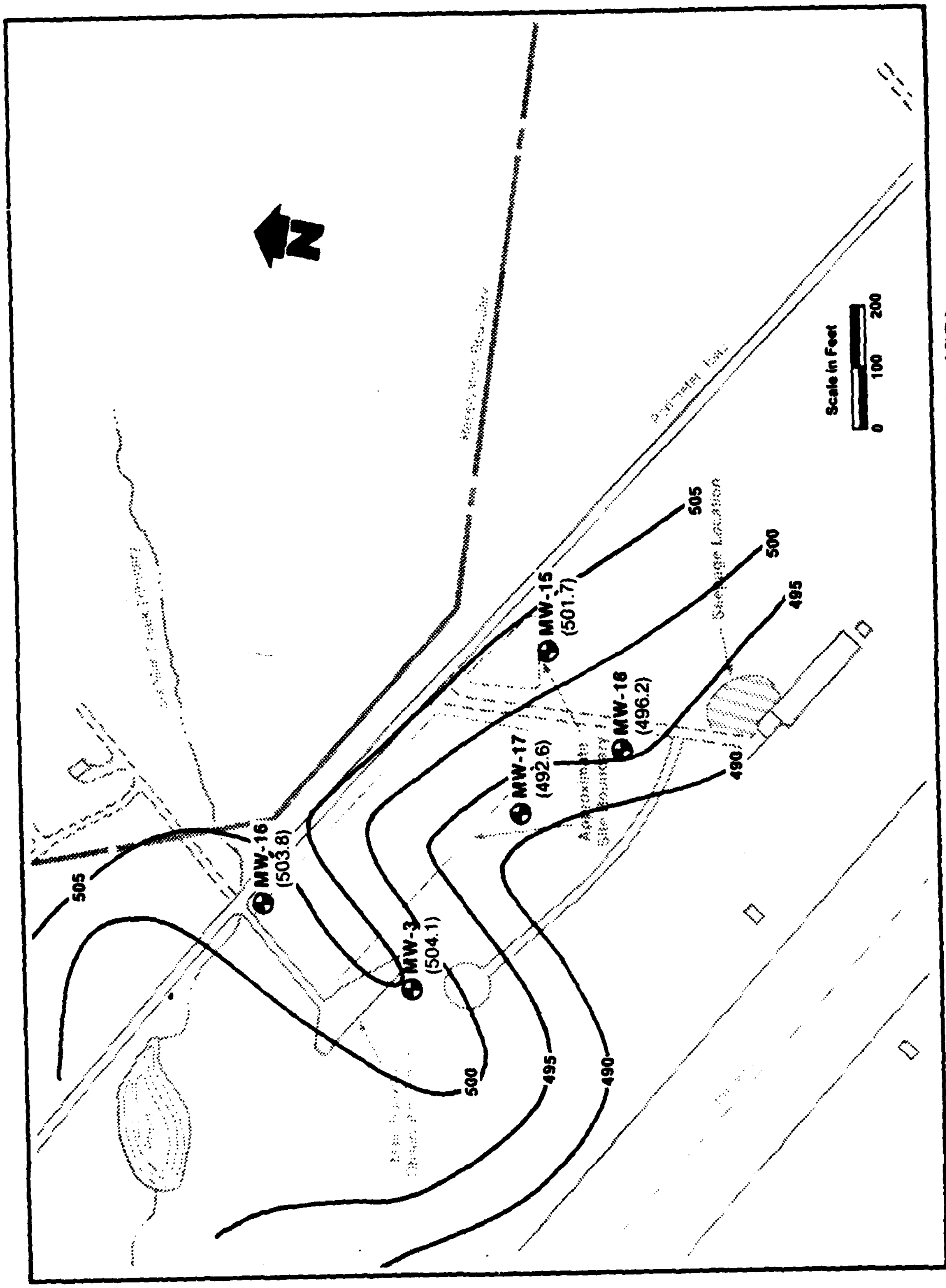


FIGURE 4-2 GROUNDWATER CONTOUR MAP OF THE LANDFILL 7 AREA

Using the same approach used in Section 4.2.1, the seepage velocity of ground water at Landfill 7 is:

$$v = K\frac{i}{n} = \frac{5.8 \text{ ft.}}{\text{day}} \times \frac{0.5}{0.3} = 0.96 \frac{\text{ft.}}{\text{day}}$$

$$v = \frac{1.0 \text{ ft.}}{\text{day}} = 365 \frac{\text{ft.}}{\text{yr.}}$$

In other words, ground-water seepage velocities around Landfill 7 are 1-2 orders of magnitude greater than velocities near the Tank Farm and Building 210.

4.3.1 Tank Farm Water Quality Analyses

Table 4-2 presents the results of the analyses of water samples from nine monitoring wells at the Tank Farm area. The following summarizes these results: Oil and grease was found in concentrations of 0.2 to 20.6 mg/l in all wells except for the upgradient background well MW-28. The highest concentrations were found in Wells MW-26 (20.6 mg/l) and MW-21 (12.7 mg/l), which are directly downgradient of the center of the Tank Farm and the railroad loading area (See Figure 3-4). Lead was found in only one well (MW-21) in concentrations of 20 ug/l (that is, just detectable). Total organic carbon was detected in five downgradient wells at levels of 10 to 30 mg/l.

4.3.2 Building 210 Water Quality Analyses

The results of the analyses of samples from wells MW-19 and MW-20 are also presented in Table 4-2. Oil and grease was found in both samples at concentrations of 0.2 mg/l. No lead was found in either sample. Total organic carbon was found at concentrations of 20 to 40 mg/l.

4.3.3 Landfill 7, Results of Water Quality Analysis

Table 4-3 presents a tabulation of results for the analyses of the five wells and the surface seepage area at Landfill 7. The results are summarized as follows: Phenols were found in only two wells, MW-3 (.019 mg/l) and MW-16 (.008

TABLE 4-2

WATER QUALITY ANALYSES RESULTS

TANK FARM AND BLDG. 210

	Oil and Grease mg/l	TOC mg/l	LEAD ug/l
BLDG. 210			
MW 19	0.2	40	<10
MW-20	0.2	30	<10
MW-20 (dup)	0.3	20	<10
TANK FARM			
MW-21	12.4	30	20
MW-22	7.3	10	<10
MW-23	1.2	30	<10
MW-24	0.3	20	<10
MW-25	0.4	< 2	<10
MW-25 (dup)	0.2	< 2	<10
MW-26	20.6	< 2	<10
MW-27	0.6	< 2	<10
MW-28	<0.1	< 2	<10
Existing Well	1.3	20	<10
BLANK	<0.1	< 2	<10
Detection Limits	0.1	2	10

TABLE 4-3

WATER QUALITY ANALYSES RESULTS, LANDFILL 7

	OIL & GREASE (mg/l)	TOC (mg/l)	TETRACHLORO-[1] ETHYLENE (ug/l)	LEAD[2] (ug/l)	COPPER[2] (mg/l)	PHENOLS (mg/l)
MW-3	0.70	70	1.6	<10	0.05	0.02
MW-15	0.20	10	3.9	<10	<0.03	<0.005
MW-16	0.10	80	2.8	20	0.05	0.008
MW-16 (duplicate)	0.20	90	-	20	0.09	<0.005
MW-17	0.50	50	105	30	0.06	<0.005
MW-18	0.30	20	1.0	<10	0.08	<0.005
MW-15 (duplicate)	-	-	1.5	-	-	-
Seepage	<0.1	20	1.0	<10	<0.03	<0.005
Blank	<0.1	< 9	1.0	<10	<0.03	<0.005
Detection Limit	0.1	9	1.0	10	0.03	0.005

[2] Other metals analyzed were not detected. They include As(<10 ug/l), Cd(<10 ug/l), Cr(<0.05 mg/l), Ni(<0.1 mg/l), Ag(<10 ug/l) and Hg(<1 ug/l).

[1] No other volatile organic compounds analyzed by EPA method 601 and 602 were detected.

mg/l), although a duplicate MW-16 sample had no phenols detected. Oil and grease were detectable in all wells in the range of 0.3 to 0.7 mg/l, while 0.7 mg/l oil and grease was detected in the seepage samples. Lead was found in two wells (MW-16 and MW-17) at levels of 20 and 30 ug/l respectively. Copper was found in four wells at levels of 50 to 90 ug/l. No other metals were detected. Total organic carbon (TOC) ranged from 20 to 90 mg/l in the wells and 20 mg/l in the seepage. The only volatile organic compound detected was tetrachloroethylene which was found in the sample from MW-17 at concentrations of 105 ug/l, and in concentrations of 3.9 ug/l or less in three other wells. The field blank had concentrations at the detection limit of 1.0 ug/l which indicates that concentrations found near the detection limit, particularly in the MW-18 and the Seep Sample results of 1.0 ug/l, may not be significant.

4.4 RESULTS OF BATTERY ACID DISPOSAL PIT SOILS ANALYSIS

The soil samples collected from the Battery Acid Disposal Pits in Buildings 101 and 222 were analyzed for the heavy metals listed in Table 4-4. This table shows the concentrations of the analytes found in each sample, the depth at which the sample was taken, and a full description of each sample. A background sample, 1-1, was taken from a nearby field to serve as a background reference for the analytes present in the soil.

As shown in Figure 4-4, lead (Pb), copper (Cu) and zinc (Zn) were found in high concentrations in the first sample of each pit (0-2 feet depth). Pb concentrations for pits 101 and 222 were approximately 3300 and 2600 times higher, respectively, than the background concentrations. The concentration of Pb in successive samples decreased with depth to less than 110 ug/g in the bottom sample of each pit. Cu concentrations decreased abruptly with depth, in successive samples, to less than background (45 ug/g) in the bottom of each pit.

The concentration of zinc (Zn) in the top samples of pits 101 and 222 was 13 to 16 times higher, respectively, than the 20 ug/g in background sample 1-1. The trend shown in Zn concentrations with depth was similar to the one seen for the Cu concentrations. The second sample taken in each pit had a marked decrease in Zn. The bottom sample of pit 101 (6-8 feet) still had Zn concentrations 3.5 times higher than background, but the samples taken from 8-12 feet in pit 222 had Zn levels lower than background.

TABLE 4-4

SOILS ANALYSES RESULTS - DRY WELLS

Sample #	Depth (Ft.)	Units	Fe	Pb	Cu	Mn	Zn	Sb	Cr	Description
1-1	Background	ug/g	6,700	<25	45	215	20	19	10	Dark yellowish brown silty sand
101-1	0-2	"	6,430	83,000	784	27	262	193	34	Greenish gray fine to medium sandy silt, wet.
101-2	2-4	"	448	1,170	30	5	9	11	4	Greenish gray fine to medium sandy silt, wet.
101-3	4-6		26,000	465	62	33	29	11	12	Greenish gray, fine to medium sandy silt, wet.
101-4	6-8	"	4,300	53	42	161	72	7	3	Grayish brown silty fine coarse sand, fine to coarse gravel, wet.
222-1	0-2	"	302	65,800	500	3	329	25	6	Greenish gray silty fine to medium sand, gravel.
222-2	2-4	"	366	861	16	4	85	5	< 3	Greenish gray silty fine to med. sand, hardened carbonate
222-3	4-6	"	322	784	171	< 1	128	6	3	Dark greenish gray fine to med. sand, gravel, carbonate
222-4	6-8	"	324	638	9	< 1	29	6	< 3	Dark greenish gray fine to med. sand, gravel, carbonate
222-5	8-10	"	38	364	5	< 1	14	4	< 3	Dark greenish gray silty fine to coarse sand, gravel, damp.
222-6	10-12	"	107	107	11	< 1	20	5	<3	Grayish brown fine to coarse sand, gravel, damp.
Detection Limits			3	25	2	1	1	10	3	

Note: Mercury (Hg) not detected in any sample - Hg <0.5 ug/g.

The only other analytes which showed a concentration above background were antimony (Sb) and chromium (Cr) in pit 101. The sample taken at 0-2 feet had 193 ug/g Sb, which is 10 times higher than background levels, and 34 ug/g Cr, which is 3.4 times background. The remaining samples had Sb and Cr levels near or below background, as did the samples from pit 222.

Of the remaining analytes, manganese (Mn) was not found in concentrations above background levels. Fe was found to be naturally high in this area, with a concentration of 6700 ug/g in the background sample. Only one sample, 101-3 (4'-6'), had levels above background (26,000 ug/g).

Several trends that can be seen in these results are the following:

1. All parameter concentrations either attenuated with depth or showed isolated increases which were still close to or below background levels, and

2. The samples taken at 0-2 feet in each pit showed much higher concentrations of Pb, Cu, Sb and Zn than the other samples. These concentrations dropped abruptly below a depth of two feet.

4.5 SIGNIFICANCE OF FINDINGS

The results of the chemical analyses of ground water samples can be compared to established standards and criteria presented in Table 4-5. Oil and grease was detected in all samples except MW-28 (the background well at the Tank Farm). The only criterion for oil and grease is an aesthetic criterion for taste and odor, which is at the detection limit of 0.1 mg/l. There is no general standard for total organic carbon, which can be elevated in naturally organic rich water. However, background levels in the glacial sand aquifer appear to be below the detection limit; thus TOC levels in wells from all three sites indicate some site impact on the ground water.

Lead analysis was completed on all water samples and measurable concentrations were found only in one well at the Tank Farm (MW-2) and two wells at Landfill 7. No sample exceeded EPA minimum drinking water standards of 50 ug/l. A Priority Pollutant metals analysis was completed on the Landfill #7 samples. In addition to lead, only copper was

Table 4-5

Water Quality Standards, Guidelines and Criteria*

Detected Parameter	Concentration	Reference
TOC	None	General Indicator
Oil and Grease	100 ug/l	Taste and odor threshold
Phenol	300 ug/l	Taste and odor threshold
Copper	1,000 ug/l	Federal Ambient Water Criterion
Lead	50 ug/l	Federal Primary Drinking Water Standards

* See Appendix J for a discussion of these criteria

detected at levels of 50 to 90 ug/l in four wells. This is well below the minimum EPA primary drinking water standard of 1,000 ug/l. Phenol was detected in only two wells at Landfill 7, at concentrations of .008 and .02 mg/l, well below the taste and odor threshhold of 0.30 mg/l. Analysis of water samples from Landfill 7 for EPA Priority Pollutant volatile organic compounds (methods 601-601) found only one compound, tetrachloroethylene. Concentrations in MW-17 were 105 ug/l. Three other wells contained concentrations of 1.5 to 3.9 ug/l. Tetrachloroethylene was commonly used in the past in septic system treatment.

The potential for migration of dissolved contaminants in the ground water is dependent in part on the ground water seepage velocity. For the normal range of soil permeabilities, this velocity represents the maximum migration rate of dissolved contaminants in ground water.

Organic compounds and trace metals are subject to adsorbtion in the soils which retards migration. This attenuation is a function of soil conditions and the chemical environment in ground water which determines the adsorbtion capabilities of the soil particles. In general, the actual migration rate is some fraction of the seepage velocity, so that migration rates based on seepage velocity yield worst case estimates of contaminant migration.

4.5.1 <u>Tank Farm, Significance of Findings</u>

The investigation at the Tank Farm focused on three aspects of subsurface contamination by fuel products: visible contamination of subsoils, migration of fuel product on the ground water surface, and the migration of dissolved constituents in the ground water. As a result of placing soil borings and temporary well points at the site, four principal areas of visible soil and ground water contamination were identified:

- East of the above-ground tanks
- Along the southern border of the Tank Farm
- To the south of the Tank Farm at the northwest corner of the Building 3 parking lot
- At the truck loading dock at the northeast corner of the site.

These four areas are shown on Figure 3-3.

A central question in the investigation was whether the fuel product found initially in the Building 3 parking lot was a part of a mass of fuel dispersing on the ground-water surface from the Tank Farm area. Evidence from the temporary well points and permanent monitoring wells indicates that this is not the case, and that the contaminated areas are not continuous. Particularly, borings and wells located between the Building 3 area and the Tank Farm contained no free floating fuel product. Wells downgradient of all visible soil contamination were also free of floating fuel.

Generally, the migration of fuel on the water table is limited by the capillary forces in the sediments. If the volume of fuel is limited, lateral spreading will initially be due to gravity forces produced by the mound of fuel. As the body spreads, gravity forces dissipate and capillary forces will be the main driver. Capillary movement ceases when a saturation point is reached where all the fuel is held in the pore spaces by the capillary forces. At this point, the fuel mass is immobile. This condition appears to be the case observed at the Tank Farm, where distinct areas of contamination are observed on the water table and in the soils. They are not continuous, and migration of fuel product is limited. Past activity to the north of the Building 3 area is a possible cause of soil and water contamination in that area. The limited nature of contamination also suggests that the problems have occurred because of numerous minor housekeeping problems rather than due to major spills or chronic leaks from tanks or lines.

Although the impact of free floating fuels on ground water is limited, the fuels provide a constant supply of dissolved constituents to the ground water system. The migration potential for these compounds is closer to the seepage velocity of the ground water itself, approximately 10 feet per year. As discussed in Section 4.2.1, dissolved amounts of oils and grease, and total organic carbon were found in all downgradient wells.

The discharge area for ground water from the Tank Farm area is Three Mile Creek. Based on a travel time for ground water in this area of 10 feet per year, ground water and associated contaminants would not have reached Three Mile Creek, which is several thousand feet away, during the Tank Farm's forty year history. In any case, Three Mile Creek is a discharge stream for Base storm water. The impact of ground-water petroleum contaminants in creek base flow would

be negligible compared to levels of similar contaminants to be expected in normal storm runoff from this kind of facility.

4.5.2 Building 210, Significance of Findings

No visible fuel product was encountered in soils or ground water at Building 210. Levels of oil and grease were encountered at 0.2 to 0.3 mg/l (slightly above the detection limit of 0.1 mg/l) in the two well samples. TOC levels were also slightly higher than those found in Tank Farm wells. No lead was found in either sample. With the removal of the buried tank, there is no major source of fuel contamination at Building 210, and the presence of dissolved contaminants in the ground water is limited, although slightly elevated TOC levels may possibly indicate organic compounds associated with fuel products.

4.5.3 Landfill 7, Significance of Findings

While the analytical results of water samples from Landfill 7 do not indicate a major ground water contamination problem, the hydrologic and water quality analysis clearly shows that the landfill does impact ground water quality. The construction of the trenches and the nature of the soil cover allows for abundant percolation of direct precipitation through the waste. Ground water mounding has developed, and the water table is either very near or intercepts the buried waste. Ground water flow from the site is primarily in the southern direction away from the nearby northern boundary of the Base, although the mounding produces groundwater flow in radial directions close to the site. Although Six Mile Creek runs through a culvert at this point, ground water flow from the landfill could reach the holding pond to the west of the site. Vertical ground water flow and migration of contaminants is restricted at the site by a clay till below the water-bearing sands.

Landfill 7, in contrast to the Tank Farm area, is located in an area where ground-water seepage velocities are much higher and a surface water discharge area is nearby. Although Six Mile Creek is buried in a culvert at this point, the tributary stream to the northwest of the landfill may receive recharge from a portion of the ground-water mound associated with the landfill.

4.5.4 Battery Acid Disposal Pits, Significance of Findings

There are currently no quality standards, guidelines or criteria for soils quality in regard to the majority of contaminants. For clean-up purposes, target concentrations for specific contaminants are usually established on a case-by-case basis. Of the heavy metals analyzed for in the soil samples taken from the battery acid pits, only lead, copper and zinc showed levels significantly above the background. In order to better understand the amount of these metals, the concentrations were converted to net weights using estimated bulk weights of the sludge and soil. Appendix K shows the tabulated results. Between 50 and 70 pounds of Pb are estimated to be present in each Battery Acid Disposal Pit, and less than one pound each of Cr and Zn in each Battery Acid Disposal Pit. This tabulation clearly shows the attenuative capacities of the soil,since 96 to 98% of the Pb by weight was found in the top two feet of the sludge. It is not known what effect, if any, this heavy metal contamination has on the ground water quality around the site. Since the Battery Acid Disposal Pits are located within buildings, above the water table, the only driving force to carry contaminants to the ground water table is liquid washed into the Battery Acid Disposal Pits, such as liquid from the batteries themselves, floor wash water, and other incidental liquid disposal.

4.6 CONCLUSIONS

Based on the results of this Phase II, Stage 2 study at Griffiss AFB, Rome, New York, the following key conclusions are drawn:

1. The Base is underlain by unconsolidated permeable sands and gravels of glacial origin. Ground water occurs under shallow water table conditions throughout the Base. Flow is generally toward the south and southwest.

2. The velocity of ground water flow varies with the gradient which is in a large part influenced by direct precipitation recharge. Recharge in the central Base facility where the Tank Farm, Building 210, and the Battery Acid Disposal Pits are located is limited by building and paving cover. Thus, gradients and seepage

velocities are low (10 feet per year). In contrast, permeable cover soils at Landfill 7 allow abundant percolation through the landfill, causing groundwater mounding and steep hydraulic gradient, with ground water seepage velocities on the order of 300 feet per year.

3. Fuel product contamination of soils and ground water is evident at the Tank Farm near tanks, loading areas, and at the parking lot area of Building 3. However, extensive migration of fuel product on the ground water surface has not occurred. Contamination of soils at Building 3 may be associated with past activities at that site, rather than associated with the Tank Farm. Although downgradient monitor wells are not showing the presence of fuel product as a separate phase, analysis for dissolved constituents confirmed the presence of oil and grease compounds and total organic carbon above background levels. Lead was found in only one well at levels well below minimum EPA Primary Drinking Water Standards.

4. No soil contamination or fuel product as a separate phase was observed at Building 210. Samples from both downgradient wells, however, had levels of oils and grease and total organic carbon comparable to the Tank Farm well samples.

5. The shallow water table and high permeability of native soils at Landfill 7 indicate the potential for percolation of direct precipitation through the landfill to carry contaminants to the ground water. Water quality results from the five wells and one seep at the site indicate an impact on ground water, particularly for oils and grease and total organic carbon. A mounding is evident in the ground water surface at the site, and the ground water surface may intersect the base of the landfill, although this is not confirmed. The seepage in the southeast corner of the site is an expression of the high water table, perched on an underlying till, and not direct leachate from the landfill.

6. Soil and sludge samples taken from depths of 0-2 feet in the Battery Acid Pits contained elevated levels of lead, copper, antimony and zinc. These concentrations dropped abruptly with depth to background or near-background levels.

SECTION 5

ALTERNATIVES

5.1 GENERAL

The purpose of the Phase II, Stage 2 investigation at Griffiss AFB was to determine whether environmental degradation has occurred at the sites identified in this report. The results presented in Section 4 confirm that each site investigated has affected, in some way, ground waters and soils beneath these sites. In some cases, the impact is not significant with little potential for migration. The findings of the field investigation indicate, in some cases; however, the need for verification or remedial actions which are discussed in Section 5 (Alternatives) and Section 6 (Recommendations). The measures discussed below focus on the problem definition aspects of environmental contamination at Griffiss AFB, and alternatives for possible remedial action.

5.2 TANK FARM ALTERNATIVES

It has been determined that soil and ground water contamination by fuel products is present in this area. The lack of fuel product in the downgradient monitoring wells indicates that the extent of migration of separate-phase floating fuel product is limited to near-the-source areas and apparently has stabilized. A common method of remediation used for fuel occurrence in ground water is to pump and recover fuel product using recovery wells and a variety of pumping or bailing systems. The effectiveness of such a system would depend on its ability to contain the plume and to recover large amounts of fuel in proportion to the cost of well installation and the amount of total pumpage. Once pumped clear, the Tank Farm Monitoring Wells that contained floating fuel product contained no visible fuel even several weeks after pumping. Since the fuel doesn't appear very mobile, and pumping is not a very effective recovery method, the merits of a fuel recovery pumping system in this case do not appear to be great.

Contaminated soils, the immediate source of contaminants to the ground water, were identified in four areas in and

around the Tank Farm. The exact extent of these contaminated soils was not confirmed. However, the volumes are large in proportion to costs involved with any remediation that will include the removal or treatment of the contaminated soils. Therefore, alternatives should be examined which address the handling of large volumes of soil. Techniques available include in situ biological treatment, air stripping, land farming, and selective spot removal. These alternative must be evaluated in reference to desired clean-up goals. This evaluation is discussed further in Section 6.

5.3 BUILDING 210

There is very little known about the history of the tank leakage at that site regarding how much fuel leaked to the ground over what period of time. No visible ground water and surface water fuel contamination was observed either because contamination has dissapated or because it was not initially significant. In either case, typical remedial measures applied to fuel spills such as soil clean up or fuel recovery from ground water are not appropriate for this site. The major alternative action available is to remove the leaking tank. This has been done. In November, 1984, the tank was removed and replaced with a new steel buried tank.

5.4 LANDFILL 7

The well network surrounding Landfill 7 shows an impact on ground water quality from the landfill. Follow-up sampling is required to identify specific contaminants accounting for the elevated TOC levels. The elevated TOC levels are probably associated with the breakdown of cellulose material in the landfill and are not necessarily an indicator of hazardous compounds in the ground water. The sampling recommended will provide confirmation of this. In addition, general water quality indicators, such as chloride, sulfate, boron, pH, and conductance could also be used to assess impact on ground water and surface water.

5.5 BATTERY ACID DISPOSAL PITS

This investigation has defined the depth and amount of soil contamination by metals from the disposal of battery sludge in Battery Acid Disposal Pit at Buildings 101 and 222. In general, the metals concentration attenuates sharply with

depth in the soil. The impact on ground water quality by contaminants reaching the ground water table is largely speculative. Although measurable amounts of metals may have reached the ground water table from the Battery Acid Disposal Pit over the forty-year history of the pits, its impact on ground water is probably negligible. Because of this, and because the final remedial action will likely include the removal of the relatively small volume of sludge from the Battery Acid Disposal Pits, WESTON does not see a ground water monitoring network as a useful alternative. A more practical approach is to analyze the sludge by the EP Toxicity extraction procedures to determine if a strong potential for ground water contamination exists in this area. This is a leachability test which measures the ability of the metals to enter a solution at a given pH. The results of the test will also determine if the sludge needs to be classified as a hazardous waste for disposal purposes.

SECTION 6

RECOMMENDATIONS

6.1 GENERAL

The findings of this Phase II, Stage 2 study at Griffiss AFB indicate the need for limited follow-up work at Landfill 7. In addition, a remedial effort should proceed at the Tank Farm and the Battery Acid pits. Potential remedial actions for these sites are discussed in the following sections.

6.2 TANK FARM

Because of the observed impact on soil and ground water due to past fuel spills in the TANK FARM AREA, it is recommended that the Air Force proceed with a remediation phase at that site. Section 6.6 outlines the general steps that would be included in a remedial action assessment. The actual remedial action taken at the site should be based on this assessment which would include the cost-benefit of any action as well as its technical feasibility.

The following initial site specific observations are also added regarding remediation at the TANK FARM SITE:

1. Floating fuel product on the ground water surface appears very limited. A skimmer well or similar type recovery system would not be very efficient or produce a large recovery of fuel.

2. Soil contamination by fuel product is widespread and provides a source of contamination to the ground water. Remediation of soil contamination at and above the water table should be examined. Because the large volumes involved, in situ or on site treatment methods may be preferable to disposal of contamination soils.

6.3 BUILDING 210

No further action is recommended at the Building 210 buried fuel tank site. However, the existing monitor wells should be maintained in the event that monitoring of the new tank is desired.

6.4 LANDFILL 7

Landfill 7 has been closed for thirty years. The area is graded with a good grass cover. Ground water samples contained one Priority Pollutant Volatile Organic Compound (Tetrachloroethylene), which was elevated at one well (MW-17, 105 ug/l). TOC was also elevated in most monitor wells. Elevated TOC is most likely due to the breakdown of cellulose material in the landfill. However, the possible presence of Priority Pollutant Organic Compounds should be ruled out by additional selective sampling. The results of these analyses will determine what, if any, additional remediation is appropriate. Therefore, additional sampling is recommended:

1. All wells should be resampled to confirm the results of the first round of analyses.

2. All well samples, samples from the seep, and two surface water samples should be analyzed for chloride, boron and sulfate.

3. MW-16 and MW-17 where TOC levels were highest, should be sampled for EPA Priority Pollutant base neutral/acid extractable compounds, and pesticides.

6.5 BATTERY ACID DISPOSAL PITS

1. No further investigation of the Battery Acid Disposal Pits is recommended. However, the pits should be properly sealed to prevent their use for disposal of any liquids, including clean water, which could drive contaminants to the water table.

2. A remedial action assessment as discussed in section 6.6 should be initiated to determine suitable remedial alternatives for these pits. In situ, isolation or removal and disposal are

possible alternatives for the small volume of sludge involved (less than 1.5 cubic yards).

3. EP Toxicity Tests should be performed on samples from each pit.

6.6 REMEDIAL ACTION ASSESSMENT

A preliminary concept engineering study should be initiated to evaluate potential remedial options for implementation at the Task Farm and Battery Acid Disposal Pits. The objective of this assessment will be the development and evaluation of remedial alternatives, and the identification and recommendation of the most cost-effective remedial action(s).

Based on the present contamination information for Griffiss, a number of remedial alternatives should be considered for the sites. The categories of potential remedial actions that can be developed include:

- No action
- Contaminated soil/waste isolation
- Contaminated soil/waste treatment
- Contaminated soil/waste disposal
- Subsurface environmental isolation
- Ground water treatment

Remedial alternatives combining elements of source isolation/treatment/disposal and ground water isolation/treatment should also be considered for evaluation. It is likely that the recommended alternative for Griffiss will be such a combination of remedial actions.

The alternatives analysis will be performed in accordance with Subpart F of the National Contingency Plan. The key components of this evaluation will include:

- Evaluation of Technologies
- Development of alternatives
- Initial screening of alternatives
- Detailed analysis of alternatives
- Selection of a remedy

The criteria which will be utilized in the detailed analysis of alternatives include:

- <u>Technical feasibility</u> including technical risks, degree of technology demonstrated, commercial availability, etc.

- <u>Cost effectiveness</u> and analysis based on total cost versus meeting environmental objectives.

- <u>Implementation time frame</u> and schedule including equipment procurement, field operations, etc.

- <u>Environmental effectiveness</u> based on protecting ground water quality and reducing long-term hazards.

- <u>Institutional factors</u> such as permit requirements and regulatory agency acceptance.

Based on the results of the detailed analysis, a remedial action strategy will be recommended for each site. The selected alternative will be the remedial program that effectively mitigates/minimizes the ground water/ soil contamination in the most cost-effective manner.

APPENDIX A

ACRONYMS, DEFINITIONS, NOMENCLATURE AND UNITS OF MEASUREMENT

APPENDIX

AFB	Air Force Base
ASTM	American Society for Testing and Materials
Aquifer	zone beneath the earth's surface capable of producing water for a well
Alconox (brand name)	A powder detergent for laboratory use
Avgas	Aviation Gas
BGS	Below Ground Surface
Cathead	A winch device which is rigged to lift drilling rods and other sampling equipment
CERCLA	Comprehensive Environmental Response Compensation and Liability Act of 1980
cm/s	centimeters per second
^{o}C	Degrees Centigrade
DoD	Department of Defense
EPA Priority Pollutant	Identified by the Environmental Protection Agency as specific elements or compounds that occur in ground and surface water that lead to health hazards and/or have toxic effects on humans.
gpm	gallons per minute
Griffiss	Griffiss Air Force Base
Ground-Water Divide	a line on the water table on each side of which the ground water table slopes away from the line.
Ground-Water Surface	the level below which the earth is saturated.
Hydraulic Gradient	change in pressure or head in the ground water over a given distance of flow
IRP	Installation Restoration Program

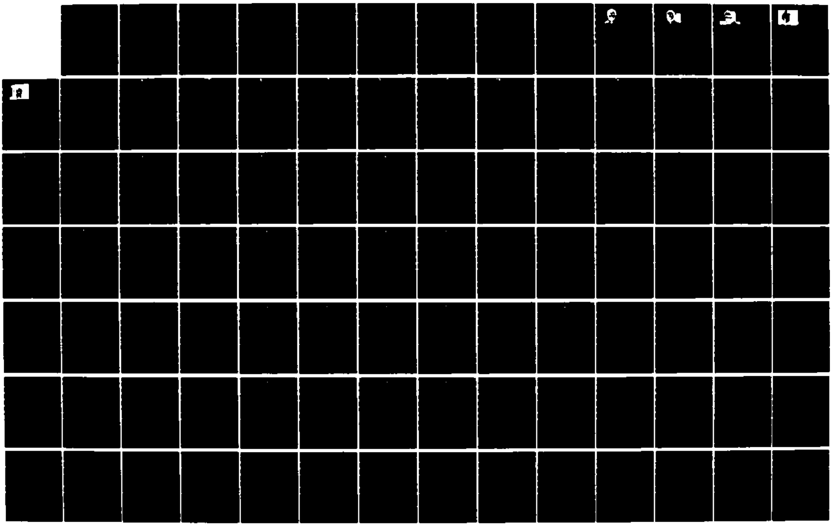
ug/l	micrograms per liter (equivalent to parts per billion in water).
umho/cm	micromhos per centimeter (units of Specific Conductance).
ug/g	Micrograms per gram (equivalent to parts per million in water)
ug/kg	Micrograms per kilogram (equivalent to parts per billion in water).
mg/l	milligrams per liter (equivalent to parts per million in water).
mgd	million gallons per day
Mogas	Motor vehicle fuel
MSL	Mean Sea Level Datum
N	North
No.	number
OEHL	Occupational and Environmental Health Laboratory
pH	negative logarithm of the hydrogen ion concentration in water.
P.G.	Registered Professional Geologist
ppb	parts per billion (equivalent to ug/l in water).
ppm	parts per million (equivalent to mg/l in water).
PVC	poly-vinyl chloride, rigid plastic used in constructing riser pipe and well screen.
Seepage Velocity	the distance ground water moves through a finite length of aquifer per unit time. The actual velocity of a water molecule is greater because the intergranular path is longer than a straight line.

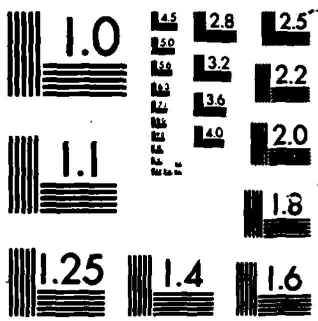
Gauge	A stake set in a stream with reference marks for measuring water levels. The elevation of the reference marks is established by a survey.
TOC	Total Organic Carbon
Transmissivity	rate of flow through a unit thickness of aquifer under a hydraulic gradient of one.
Unconsolidated Sediments	sediments that are uncemented and thus contain interconnected void space (primary porosity) that allow for the storage and transmission of groundwater.
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOA	Volatile Organic Compounds

APPENDIX B

SCOPE OF WORK, TASK ORDER 0041

AD-A164 416 INSTALLATION RESTORATION PROGRAM PHASE II 2/3
CONFIRMATION/QUANTIFICATION STA..(U) WESTON (ROY F) INC
WEST CHESTER PA R JOHNSON ET AL. 20 FEB 85
UNCLASSIFIED F33615-80-D-4006 F/G 13/2 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

25 June 1984

INSTALLATION RESTORATION PROGRAM
Phase II Stage 2 Field Evaluation
Griffiss AFB, New York*

I. Description of Work

The purpose of this task is to determine if environmental contamination has resulted from waste disposal and fuel handling practices at Griffiss AFB NY; to identify potential environmental consequences of migrating pollutants; to identify the magnitude, extent and direction of movement of discovered contaminants.

The Phase I IRP report (mailed under separate cover) and Phase II IRP report (mailed under separate cover) incorporated background and description of the sites for this task. To accomplish the survey effort, the contractor shall take the following steps:

A. General

1. Locations where surface water samples or leachate samples are taken, or where soil exploratory borings are drilled shall be marked with a permanent marker, and the location marked on a project map of the site.

2. All water samples collected shall be analyzed on site by the contractor for pH, temperature and specific conductance. Sampling, maximum holding time and preservation of samples shall strictly comply with the following references: Standard Methods for The Examination of Water and Wastewater, 15th Ed. (1980), pp. 35-42; ASTM, Part 31, pp. 76-86, (1980), Method D-3370; and Methods for Chemical Analysis of Waters and Wastes, EPA Manual 600/4-79-020, pp. xiii to xix (1979). Minimum detection limits and methods for analysis are shown in Attachment 1.

3. Standard penetration tests and split spoon sampling shall be accomplished on all soil exploratory borings and on all monitor well borings. All wells shall be developed, water levels measured and locations surveyed and recorded on a project map and a specific site map. Groundwater monitoring wells shall, as a minimum, comply with Environmental Protection Agency Guidelines and State of New York requirements for monitoring well installation. Only screw type joints shall be used. Glued fittings are not permitted.

4. Field data collected for each zone shall be plotted and mapped. The nature, magnitude and potential for contaminant flow within each zone to receiving streams and groundwaters shall be estimated. Upon completion of the sampling and analysis, the data shall be tabulated in the next R&D Status report as specified in Item VI below.

*Highlights of modification underscored

B. In addition to items delineated in A above, conduct the following specific actions at sites identified on Griffiss AFB.

1. Tank Farm and Bldg 210

a. A Ground Penetrating Radar (GPR) sweep of each proposed boring location shall be conducted in order to verify the absence of subsurface facilities.

b. A total of 40 soil exploratory borings (10 at Building 201 and 30 at the Tank Farm) shall be completed around the sites to approximately 5 feet below the water table (20 feet total depth). A minimum of ten percent of the borings at each location shall be emplaced at sufficient distance downgradient from the site to be outside the estimated contaminant plume. Split spoon samples shall be taken at 5 feet, 10 feet and at the water table. Borings shall be monitored with an organic vapor meter to detect the presence of fuel contaminants. The results of the vapor monitoring will be included in the boring logs.

c. Temporary PVC well points shall be installed in each completed borehole. The top of each well point shall be surveyed for elevation and its location noted on a base map. Staff gauge locations shall also be surveyed at up to ten locations along nearby surface drainage-ways.

d. After the well points have stabilized for at least 48 hours, a round of water level measurements shall be made. Floating fuel product thicknesses, if present, shall also be measured.

e. A water table contour map shall be developed in the field for each site from the above data, and the groundwater gradient and direction of flow around each site shall be identified through the general discharge area including Three Mile Creek and a nearby tributary to Six Mile Creek. Fuel product plumes, if present, shall also be mapped.

f. Based on the above data, a total of 10 groundwater monitoring wells shall be installed around the sites, four at Building 201 and six at the Tank Farm Area to monitor contaminant migration. Distance criteria shall be as specified in Item I.B.1.b. These wells shall be constructed of 4-inch inside diameter PVC with 20 feet of .010 inch slotted screen, and they shall be installed in the exploratory borings as selected by the contractor in the field. The base of the screens shall be set approximately 15 feet below the water table (30 feet total depth) with the top of the screens extending above the water table to intercept floating fuel products, if present. One of the wells at the Tank Farm Area shall be an upgradient well to provide background water quality data. All wells plus the existing monitor well near Tank Farm No. 3 shall be surveyed for elevation using existing base benchmarks. Upon completion of well construction, all new wells and the existing monitor well shall be developed.

g. Aquifer characteristics tests will be conducted by slug and recovery methods on three wells to determine aquifer transmissivities.

h. After the monitoring wells have stabilized for two weeks, groundwater samples shall be recovered from each of the 11 wells. Prior to sampling, each well shall be purged of the equivalent of 3 or more casing volumes of water standing in the well. The samples shall be analyzed for the parameters shown in Attachment 2.

2. Landfill No. 7

a. A total of 4 groundwater monitoring wells shall be installed around the perimeter of the landfill. The wells shall be completed to a depth of 20 feet below the water table (35 feet total depth). At least one well shall be emplaced at sufficient distance downgradient to be outside the estimated contaminant plume. Wells shall be constructed of 4-inch diameter PVC pipe with 20 feet of well screen.

b. The four new and one existing monitor wells shall be surveyed for elevation, as well as the leachate seep and nearby surface stream points for the purpose of developing a groundwater flow map.

c. The leachate seep shall be sampled once and analyzed for the parameters shown in Attachment 2.

d. The 4 new and 1 existing monitoring wells shall be sampled for analysis of those parameters listed in Attachment 2.

e. Aquifer characteristics tests shall be conducted by slug and recover methods on one downgradient well.

3. Dry Wells (Building 101 and 220)

Two dry wells at Buildings 101 and 220 shall be evaluated to determine the extent of heavy metal contamination. The wells shall be sampled using a portable tripod rig. A split spoon sampler shall be driven into the sludge and soil at the base of each dry well. A total of five samples per well shall be collected for analysis at each of the following depths: 0-.5 ft; 1 ft; 2 ft; 4 ft; and 6 ft (10 samples total). The samples shall be analyzed for iron, lead, copper, chromium (total and hexavalent), manganese, zinc and antimony.

C. Well Installation and Cleanup

Monitor wells shall be completed with the installation of an iron security casing equipped with a lockable cap. Well installations shall be cleaned up following the completion of the well. Drill cuttings shall be removed and the general area cleaned. The exact locations of wells at each site shall be determined by the contractor in the field.

D. Data Review:

Results of sampling and analysis shall be tabulated and incorporated into the monthly R&D Status Reports and forwarded to the USAF OEHL for review as soon as they become available as specified in Item VI below.

I. Reporting

1. A draft report delineating all findings of this field investigation shall be prepared and forwarded to the USAF OEHL as specified in Item VI below for Air force review and comment. This Report shall be prepared in the format of Addendum No. 1 to the existing IRP Phase II Report for Griffiss Air Force Base. This report shall include a discussion of the site hydrogeology, well logs of all project wells, data from water level surveys, water quality analysis results, available geohydrologic cross sections, groundwater surface and flow maps, and laboratory quality assurance information.

2. Estimates shall be made of the magnitude, extent and direction of movement of contaminants discovered. Potential environmental consequences of discovered contamination shall be identified or estimated.

3. Specific requirements, if any, for future groundwater and surface water monitoring must be identified.

II. Site Location and Dates

Griffiss AFB NY
USAF Hosp/SGPB
Dates to be established

III. Base Support: Griffiss AFB shall provide the following:

A. Designation of site for disposal of drill cuttings.

B. Use of a holding tank (bowser) and designation of disposal site for contaminated groundwater generated during well development.

IV. Government Furnished Property: None

V. Government Points of Contact

1. Lt Col R.C. Wooten
USAF OEHL/TSS
Brooks AFB TX 78235
(512) 536-2158
AV 240-2158

2. Dr Dee Ann Sanders
USAF OEHL/TS
Brooks AFB TX 78235
(512) 536-2158
AV 240-2158

3. Capt John Joyce
USAF Hosp Griffiss/SGPB
Griffiss AFB NY 13441
(315) 330-3277
AV 587-3277

4. Col Ron Burnett
HQ SAC/SGPB
Offutt AFB NE 68113
(402) 294-4651
AV 271-4651

VI. In addition to sequence numbers 1, 5 and 10 which are applicable to all orders, the reference number below is applicable to this order. Also shown are data applicable to this order.

Sequence No.	Block 10	Block 11	Block 12	Block 13	Block 14
4	ONE/R	84SEP07	84OCT05	85JAN04	*

*A minimum of two draft reports will be required. After incorporating Air Force comments concerning the first draft report, the contractor shall supply the USAF OEHL with one copy of the second draft report. Upon approval by USAF OEHL, the contractor shall distribute the remaining 24 copies per a USAF OEHL-furnished distribution list. The contractor shall supply the USAF OEHL with 25 copies of each draft report and 50 copies plus the original camera ready copy of the final report.

Attachment 1
Analytical Methods and Required Detection Limits

Parameter	Method	Detection Limit
Volatile Organic Compounds (VOC)	EPA Methods 601&602	**
*Total Organic Carbon (TOC)	EPA Method 415.1	1 mg/L
Oils and Greases	EPA Method 413.2	0.1 mg/L
Phenol (total)	EPA Method 420.1	1 µg/L
Arsenic (As)	EPA Method 206.2 or 206.3	10 µg/L
Cadmium (Cd)	EPA Method 213.2	10 µg/L
Lead (Pb)	EPA Method 239.2	20 µg/L
Mercury (Hg)	EPA Method 245.1	1 µg/L
Chromium (Cr)	EPA Method 218.1	50 µg/L
Nickel (Ni)	EPA Method 249.1	100 µg/L
Silver (Ag)	EPA Method 272.2	10 µg/L
Copper (Cu)	EPA Method 220.1	20 µg/L

*Detection limit for TOC must be 3 times the noise level of the instrument. Laboratory distilled water must show no response; if it shows a response, corrections of positive results must be made.

**Detection limits for Volatile Organic Compounds shall be as specified for the compounds by EPA Methods 601-602. Method: Federal Register, Vol. 44, No. 233, pp 69468-69473. This method should be strictly followed including these items:

Item 1.4 - This method is recommended by EPA for use only by experienced residue analysts or under the close supervision of such qualified persons.

Item 2.2 - This is most important. If interferences are encountered (as in early peaks such as vinyl chloride), the method provides a secondary gas chromatographic column that will be helpful in resolving the compounds of interest from interferences. This must be done in the case of vinyl chloride and so noted in analysis report.

Items 3.3, 7.1-7.3 - These sections on interferences, contamination and QC should be strictly followed.

Item 8.3 - All samples must be analyzed within the recommended holding times. This must be followed without exception.

If questions are encountered about certain contaminants, you may be asked to show both chromatograms used to rule out possible interferences.

Attachment 2
Analytic Parameters

Parameter	Tank Farm & Bldg 210	Landfill 7	QA	Total
		Number of Samples		
Oils and Greases	11	6	2	19
TOC	11	6	2	19
VOC		6	1	7
As		6	1	7
Cd		6	1	7
Pb	11	6	2	19
Hg		6	1	7
Cr		6	1	7
Ni		6	1	7
Ag		6	1	7
Cu		6	1	7
Phenol		6	1	7

APPENDIX C

Professional Profiles of Project Personnel

Peter J. Marks

Fields of Competence

Project management; environmental analytical laboratory analysis; hazardous waste, groundwater and soil contamination; source emissions/ambient air sampling; wastewater treatment; biological monitoring methods; and environmental engineering.

Experience Summary

Eighteen years in Environmental Laboratory and Environmental Engineering as Project Scientist, Project Engineer, Process Development Supervisor, and Manager of Environmental Laboratory with WESTON. Experience in analytical laboratory, wastewater surveys, hazardous waste, groundwater and soil contamination, DoD-specific wastes, stream surveys, process development studies, and source emission and ambient air testing. In-depth experience in pulp and paper, steel, organic chemicals, pharmaceutical, glass, petroleum, petrochemical, metal plating, food industries and DoD.

Applied research on a number of advanced wastewater treatment projects funded by Federal EPA.

Credentials

B.S., Biology—Franklin and Marshall College (1963)

M.S., Environmental Engineering and Science—Drexel University (1965)

American Society for Testing and Materials

Water Pollution Control Federation

Water Pollution Control Association of Pennsylvania

Employment History

1965-Present	WESTON
1963-1964	Lancaster County General Hospital Research Laboratory for Analytical Methods Development

Key Projects

USAF/OEHL Brooks AFB. Program Manager for this three-year BOA contract provides technical support in environmental engineering surveys, wastewater characterization programs, geological investigations, hydrogeological studies, landfill leachate monitoring and landfill siting investigations, bioassay studies, wastewater and hazardous waste treatability studies, and laboratory testing and/or field investigations of environmental instrumentation/equipment. Collection, analysis, and reporting of contaminants present in water and wastewater samples in support of Air Force Environmental Health Programs.

United States Army Toxic and Hazardous Materials Agency (USATHAMA), Aberdeen Proving Ground, Maryland. Program Manager for three-year basic ordering agreement contract to provide research and development for technology in support of the DOD Installation Restoration Program. The objective of the Program is to identify and develop treatment methods/technology for containment and/or remedial action. Technology development for remedial action is to include groundwater, soils, sediments, and sludges.

Confidential Client, Ohio. Project Manager of an on-going contract to conduct corporate environmental testing and special projects at client's U.S. and overseas plants. WESTON must be able to assign up to four professionals to a project within a two week notice.

Confidential Client (Inorganic and Organic Chemicals). Product Manager of a current contract to conduct wastewater sampling and analysis of plant effluent for priority pollutants. The project also includes a wastewater treatability study to evaluate a number of process alternatives for removal of priority pollutants from the present effluent.

Confidential Client, Utah. Technical Project Manager for in-depth wastewater survey, in-plant study, treatability study, and concept engineering study in support of the client's objectives to meet 1983 effluent limitations. WESTON had two project engineers, two chemists, five technicians and an operating laboratory in the field. Field effort is six months duration.

Professional Profile

Frederick Bopp III, Ph.D., P.G.

Registration

Registered Professional Geologist in the State of Indiana

Fields of Competence

Groundwater resources evaluation; hydrogeologic evaluation of sanitary landfills and other waste disposal sites; detection and abatement of groundwater pollution; digital modeling of groundwater flow and solute transport; statistical analysis of geological and geochemical data; geochemical prospecting; estuarine geology and geochemistry; trace metal and aqueous geochemistry.

Experience Summary

Seven years experience in hydrogeology and geochemistry, involving such activities as: assessment of subsurface water and soil contamination; development of contamination profiles; evaluation of remediation actions for groundwater quality restoration; quantitative chemical analysis of water and soil; ore assay and ore body evaluation; drilling supervisor; hydrogeologic assessment; pollution detection and abatement; estuarine pollution analysis; application of flow and solute transport computer models; computer programming; project management; teaching environmental geology and geochemistry.

Credentials

B.A., Geology—Brown University (1966)

M.S., Geology—University of Delaware (1973)

Ph.D., Geology—University of Delaware (1979)

Sigma Xi, The Scientific Research Society of North America

Geological Society of America, Hydrology Division

National Water Well Association, Technical Division

American Association for the Advancement of Science

Estuarine Research Federation: Atlantic Estuarine Research Society

Employment History

1979-Present	WESTON
1977-1979	U.S. Army Corps of Engineers Waterways Experiment Station
1976-1977	University of South Florida Department of Geology
1970-1976	University of Delaware Department of Geology
1974-1976	Earth Quest Associates President and Principal Partner
1974 (Summer)	WESTON
1966-1970	United States Navy Commissioned Officer

Key Projects

Project manager on seven task orders for environmental assessment services at United States Air Force facilities in nine states.

Task manager for a Superfund site evaluation in Ohio.

Site manager for drum recovery operations in Pennsylvania and New Jersey.

Project manager for site assessments of oil and fuel spills in four states.

Project manager for closure plan development at a hazardous waste landfill in New Jersey.

Definition and abatement of groundwater contamination from chemical manufacturing in Delaware.

Flow and solute transport digital model of a heavily-pumped regional aquifer in southern New Jersey.

Definition and abatement of groundwater contamination from chemical manufacturing in the Denver area.

Hydrogeologic impact assessment of on-land dredge spoil disposal in coastal North Carolina.

Geochemical prospecting and ore body analysis in Arizona.

Professional Profile

Richard C. Johnson, P.G.

Registration

Registered Professional Geologist in the State of Virginia (No. 600)

Fields of Competence

Hydrologic and geologic investigations of waste disposal sites; engineering properties of soil and rock; laboratory determination of mechanical properties of soils; laboratory investigation of physical properties of sulfite sludges and coal burning wastes; hydrogeological analysis; petroleum contamination of groundwater; and optical and x-ray diffraction analysis of geologic materials.

Experience Summary

Over six years experience in geotechnical and geological investigations, including hydrologic and geological investigation of landfill sites; quantitative and qualitative groundwater analysis; industrial waste disposal assessment; evaluation of soil mass stability and bearing capacity at proposed sites of building and tank structures; development of remedial actions. Supervision of e[illegible]neering of laboratory programs for soil and waste material testing; supervision of well installation, well monitoring, and sampling program.

Credentials

B.A.—LaSalle College (1969)

M.A., Geology—Tempfe University (1976)

Graduate course work in soil mechanics, engineering geology and hydrology—Drexel University (1979-1981)

National Water Well Association

U.S. National Group of Engineering Geology

American Geophysical Union

Employment History

1981-Present	WESTON
1979-1981	Valley Forge Laboratories, Soils and Materials Testing Laboratory
1978-1979	Ambric Engineering
1976-1977	American Cancer Society Philadelphia Division
1972-1975	Temple University Department of Geology
1969-1971	City of Philadelphia Department of Licenses and Inspections

Key Projects

Project Geologist for investigations of existing and proposed hazardous waste disposal sites in Pennsylvania, New Jersey, Ohio, and Maine. Studies included drilling and soil sampling programs; the interpretation of hydrogeologic conditions; and evaluation of the physical stability of earth impoundments.

Project Geologist for U.S. Air Force Installation Restoration Program Phase II studies in New York, New Jersey, Pennsylvania, and Minnesota. Supervised field investigation of waste disposal and spill sites related to base activities.

Principal Hydrogeologist for a groundwater and geologic investigation at the Milan Army Ammunition Plant, Tennessee for the U.S. Army Toxic and Hazardous Materials Agency.

Development and implementation of a program for the interception and recovery of hydrocarbons in groundwater at a chemical processing plant in the Pittsburgh area.

Interpretation of hydrologic and geologic conditions related to migration of chlorinated hydrocarbons in groundwater in the vicinity of production wells at a chemical processing plant in Ohio.

Hydrogeologic investigation of the Bruin Lagoon Superfund project in Butler County, Pennsylvania.

Project Manager and Principal Investigator for a subsurface investigation to determine soil conditions at the

Deborah L. Jones

Fields of Competence

Field and laboratory soils investigations; analysis of soil characteristics and suitability for specific land use purposes, groundwater contamination detection investigations, soil erosion determination and control.

Experience Summary

Experience in soil and hydrogeological investigations including evaluation of soil erosion potential, field characterization of soils and evaluation for on-lot waste disposal, sanitary landfills, and sludge disposal; soil and groundwater sampling, soil mapping, pump test performance and analysis, geophysical surveys including use of magnetometer, ground-penetrating radar, and electromagnetic conductivity meter, air monitoring using organic vapor analyzer.

Credentials

B.S., Environmental Resource Management—Pennsylvania State University (1981)

M.S., Environmental Pollution Control, emphasis in Agronomy — Pennsylvania State University (1983)

American Society of Agronomy

Soil Science Society of America

Employment History

1983-Present	WESTON
1981-1983	Northeast Watershed Research Center USDA-ARS

Key Projects

Soil evaluation to determine site suitability for a hazardous waste disposal facility and assisted in preparation of variance request.

Soil suitability investigations for on-lot waste disposal in Chester County, PA.

Evaluation of soils to determine suitability as liner material for a hazardous waste landfill in Central Illinois.

Soils and hydrogeologic investigations to determine extent of fuel oil contamination at an Air Force Base in New York.

Intensive geophysical investigations to characterize a chemical waste disposal site for a government research firm in New Mexico.

Soil sampling and evaluation to determine extent of contamination at an industrial hazardous waste storage area in New Mexico.

Soils investigations to determine extent of pesticide contamination at a storage facility in Minnesota.

Literature search to determine state-of-the-art groundwater measurement and transport modelling techniques.

Publications

Rogowski, A.S., R.M. Khanbilvardi, and D.L. Jones. "Point Estimates of Erosion." For presentation at the 1984 summer meeting of American Society of Agricultural Engineering, University of Tennessee, Knoxville, TN, June 24-27, 1984.

Professional Profile

John A. Williams, Jr.

Fields of Competence

Geologic and geophysical investigations; geological and groundwater sampling techniques and instrumentation technology; design, operation, and evaluation of geophysical survey, equipment, testing and analysis of aquifers, and groundwater pollution.

Experience Summary

Three years experience in geologic and geophysical investigtions including subsurface profiling using Ground Penetrating Radar (GPR), electrical resistivity and electromagnetic conductivity for numerous private and government facilities; groundwater sampling and aquifer pump tests, six years experience in bathymetric, hydrographic and biological studies.

Credentials

A. S., Marine Technology - Cape Fear Technical Institute (1975)

B. S., Earth Science (Geology) - West Chester State College (1983)

Certified Ground Penetrating Radar Operator

Certified NAUI/PADDI Scuba Diver

Geological Society of America

Employment History

1982 - Present	WESTON
1980-1982	Environmental Resources Management, Inc.
1977-1980	WESTON
1976-1977	Highway Service Marineland
1975-1976	Lawler, Matusky, Skelly Engineers

Key Projects

Coordinated and supervised geophysical investigations to locate buried drums and to delineate the boundaries of a buried waste lagoon for a scrap recovery plant in Rhode Island.

Geophysical field investigation to locate buried trenches and waste lagoons for a government facility in California.

Geophysical field investigation, well installation and sample collection to determine the distribution of leachate, and the extent of contamination in a heavily-used aquifer in New York.

Geophysical investigation to define the lateral and vertical effect of fill deposition for a facility in Massachusetts.

Soils investigation to determine the extent of contamination from old waste lagoons and fire training areas for a government facility in Arizona.

Hydrogeologic investigation for a scrap recovery facility in western Pennsylvania.

Responsible for deploying benthic and water quality sampling gear and an electronic navigation system for a dredge spoils disposal study in Lake Erie.

Geophysical investigation (ground penetrating radar and electrical resistivity) to locate buried drums and delineate trench boundaries for a government facility in Ohio.

Professional Profile

APPENDIX D

Boring Logs and Well Completion Summaries

WESTON

DRILLING LOG

WELL NUMBER: MW-20
OWNER: U.S. Air Force
LOCATION: Building 210
ADDRESS: Griffiss AFB, Rome, NY
TOTAL DEPTH: 32.0'
SURFACE ELEVATION:
WATER LEVEL: 17.0'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-11-84
DRILLER: A. Boutoille
HELPER: G. Stevens
LOG BY: V. Williams

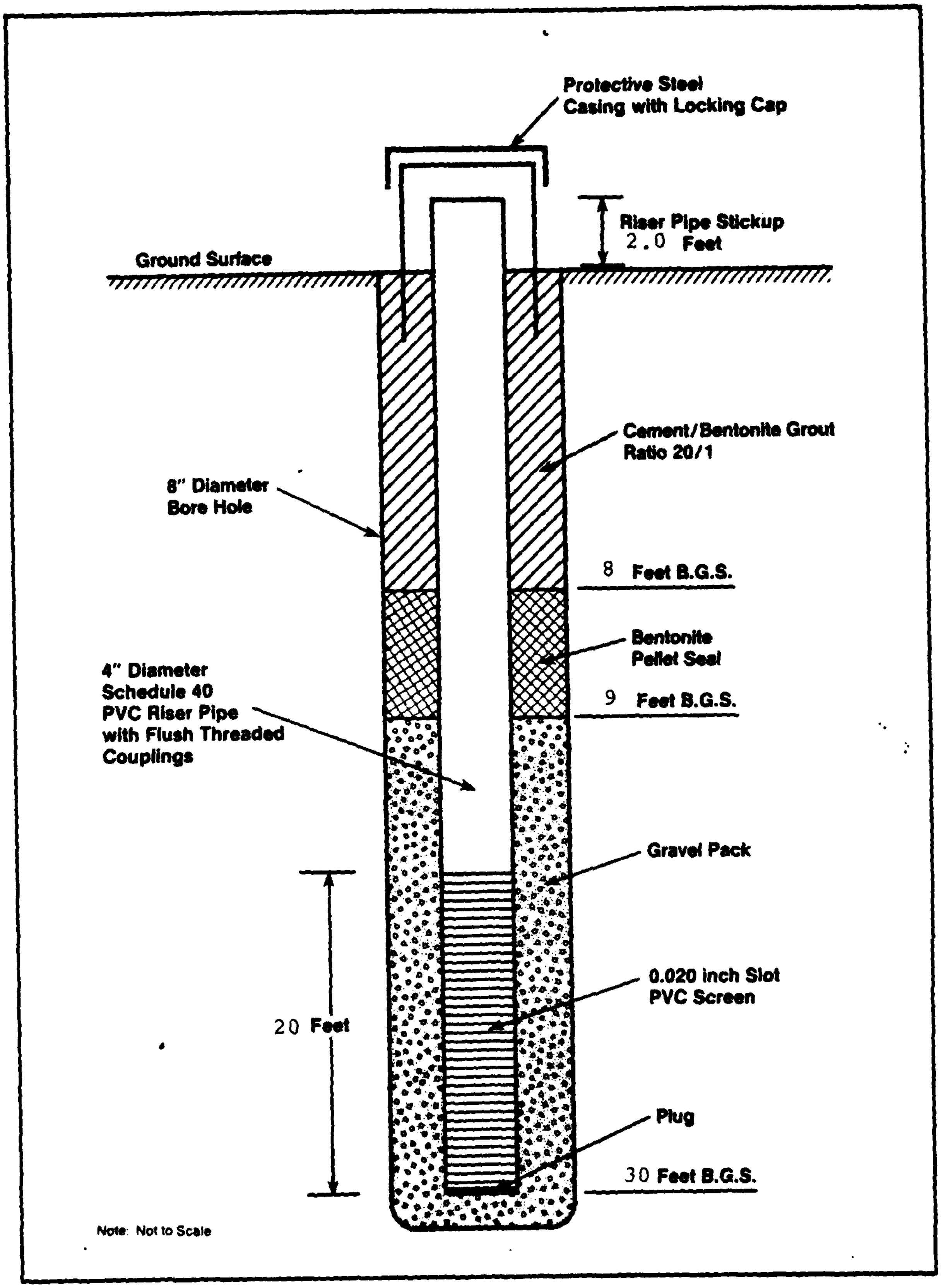
SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	4/14 21/20	0-2' Brown silty fine to coarse sand, some fine to coarse gravel, loose
5		2	SS	7/7 6/6	5-7' Dark brown fine to medium sandy silt, some fine to coarse gravel
10		3	SS	12/11 9/8	10-12' Brown fine to coarse sand and gravel wet, loose
15		4/5	SS	10/5 5/5	15-17' No recovery
20		6	SS	2/2 1/2	20-22' Brown fine to coarse sand, little silt, trace fine gravel, wet, loose
25		7	SS	5/5 7/10	25-27' Grey clayey silt, wet
30		8	SS	4/4 5/5	30-32' Same as above

* A.S.T.M. D1586

SHEET ___ OF ___



WELL CONSTRUCTION LOG
WELL NUMBER 20

WESTON

DRILLING LOG

WELL NUMBER: MW-21
OWNER: U S Air Force
LOCATION: Grassy area in front of Bldg. 3 on Brooks Rd.
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH: 27.0'
SURFACE ELEVATION:
WATER LEVEL: 11.0'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-4-84
DRILLER: A. Bouteille
HELPER: G. Sterem
LOG BY: D. Jones

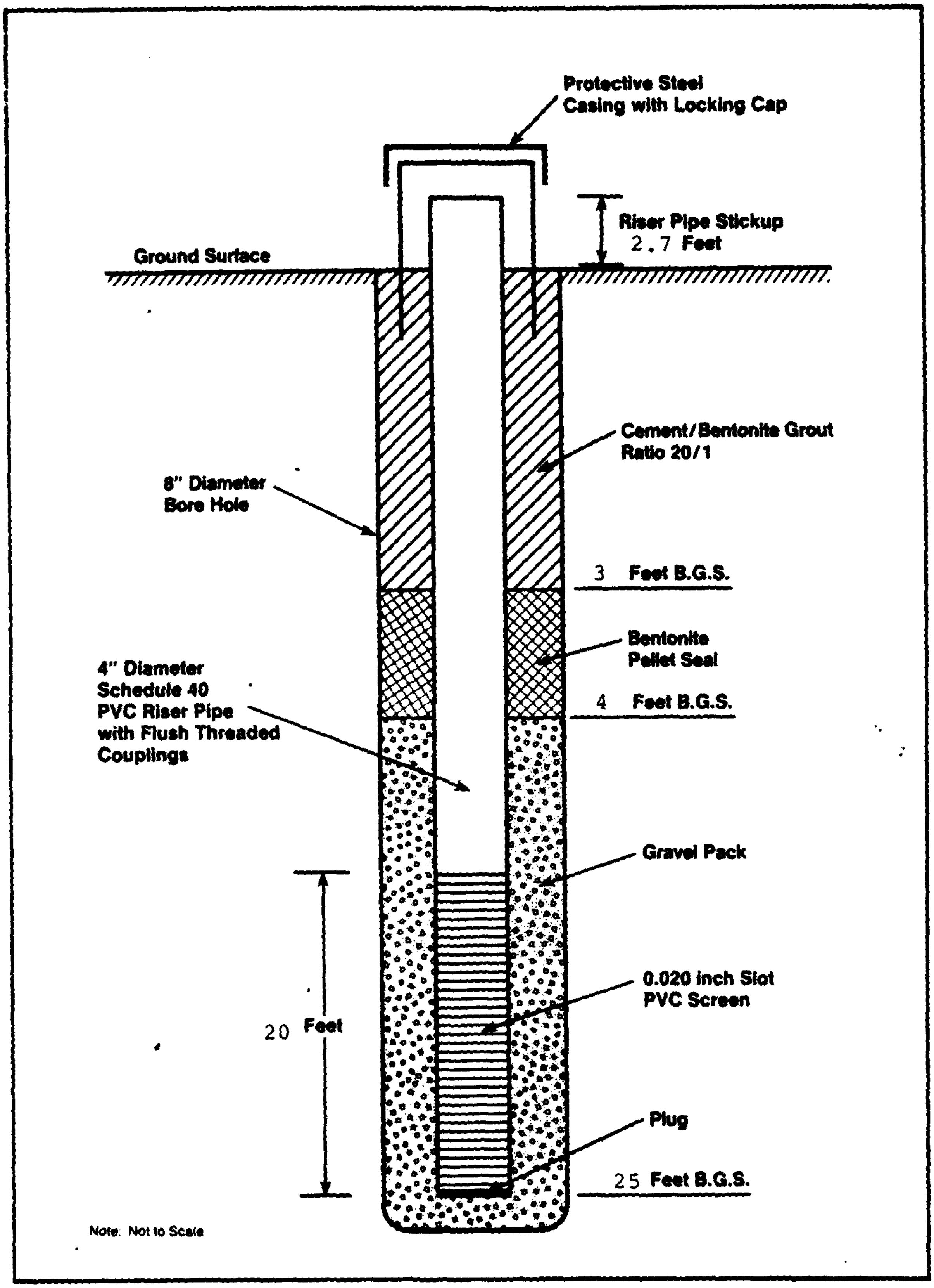
SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	2 5 8 17	0-2' Brown fine to coarse sand and gravel, some silt. Damp-firm
5		2	SS	7 7 6 6	5-7' Dark brown to reddish brown fine to coarse sand, some silt, gravel.
10		3	SS	4 5 5 8	10-12' Gray sandy silt. Moist. Strong fuel odor
15		4	SS	2 4 8 6	15-17' Same as above, faint gasoline odor
20		5	SS	4 3 32 10	20-22' Grey fine to coarse sand little fine gravel, little silt Saturated-firm
25		6	SS	3 3 4 5	25-27' Grey/Brown fine to medium sand, little silt. Saturated-loose
30					

* A.S.T.M. D1586

SHEET ___ OF ___



WELL CONSTRUCTION LOG
WELL NUMBER 21

WESTON

DRILLING LOG

WELL NUMBER: MW - 22 OWNER: U.S. Air Force

LOCATION: Grassy area along Brooks Rd across from Tank Farm

ADDRESS: Griffiss AFB Rome, NY

TOTAL DEPTH: 25.0'

SURFACE ELEVATION: ______ WATER LEVEL: 11.5'

DRILLING COMPANY: Empire DRILLING METHOD: Auger DATE DRILLED: 7-2-84

DRILLER: R. Bush HELPER: A. Boutville

LOG BY: J. Williams

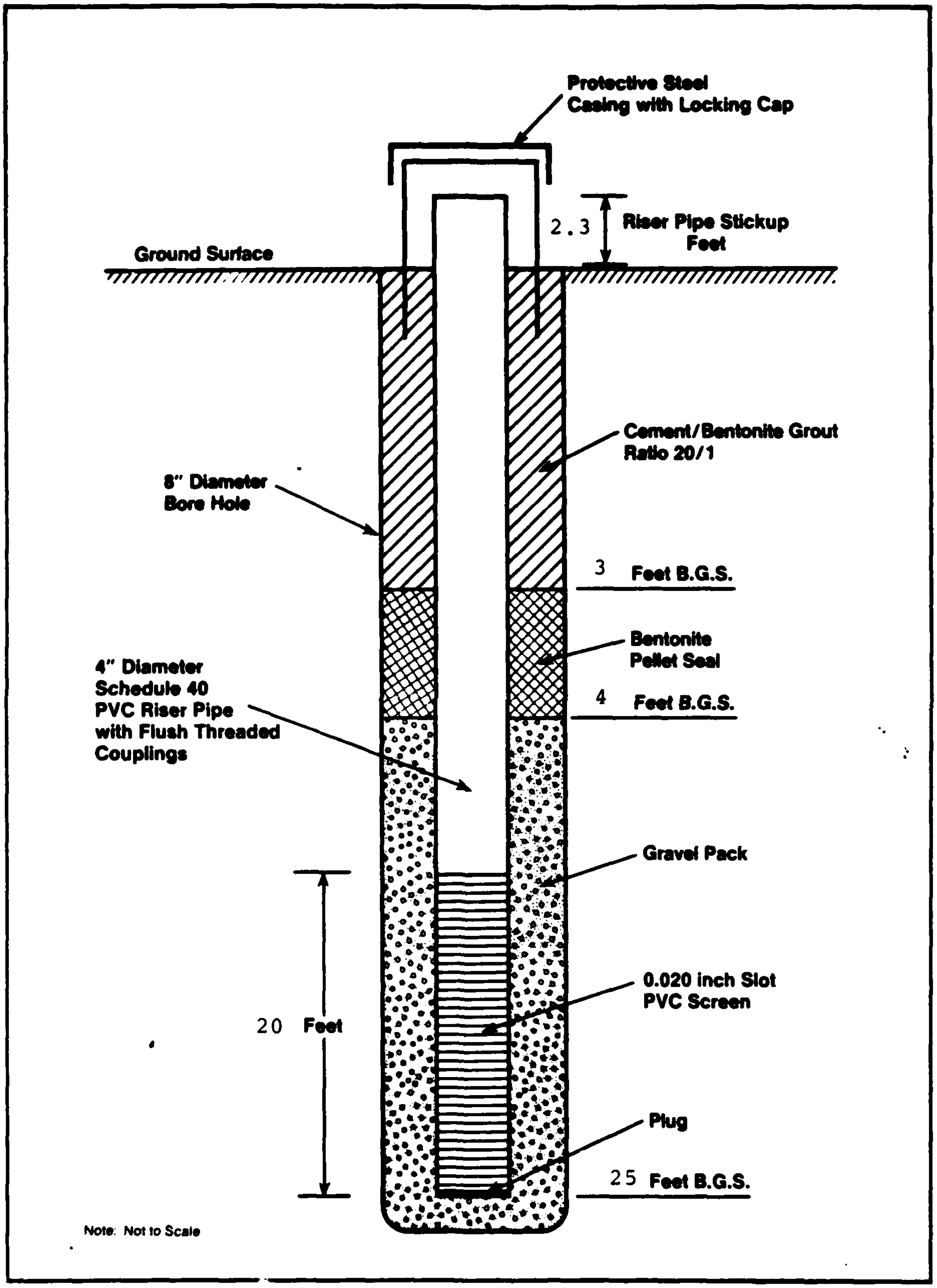
SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	4 8 6 6	0-2' Brown, fine sand and clay, gravel, damp and cohesive
5		2	SS	6 6 6 6	4-5' Brown medium sand, trace of silt. Damp
10		3	SS	4 6 6 6	10-12' Brownish black fine to coarse sand, fine to coarse gravel. Damp. Strong odor.
15		4	SS	4 4 4 4	15-17' Brown/Black fine to coarse sand, some silt, fine gravel Wet, odor
20					No Additional Samples Obtained
25					

* A.S.T.M. D1586

SHEET ___ OF ___



WELL CONSTRUCTION LOG
WELL NUMBER 22

WESTON

DRILLING LOG

WELL NUMBER: MW-23
OWNER: U.S Air Force
LOCATION: SW Corner of Brooks and Moody Rds
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH: 27.0'
SURFACE ELEVATION:
WATER LEVEL: 11.0'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-12-84
DRILLER: A. Boutcille
HELPER: G. Stevens
LOG BY: J. Williams

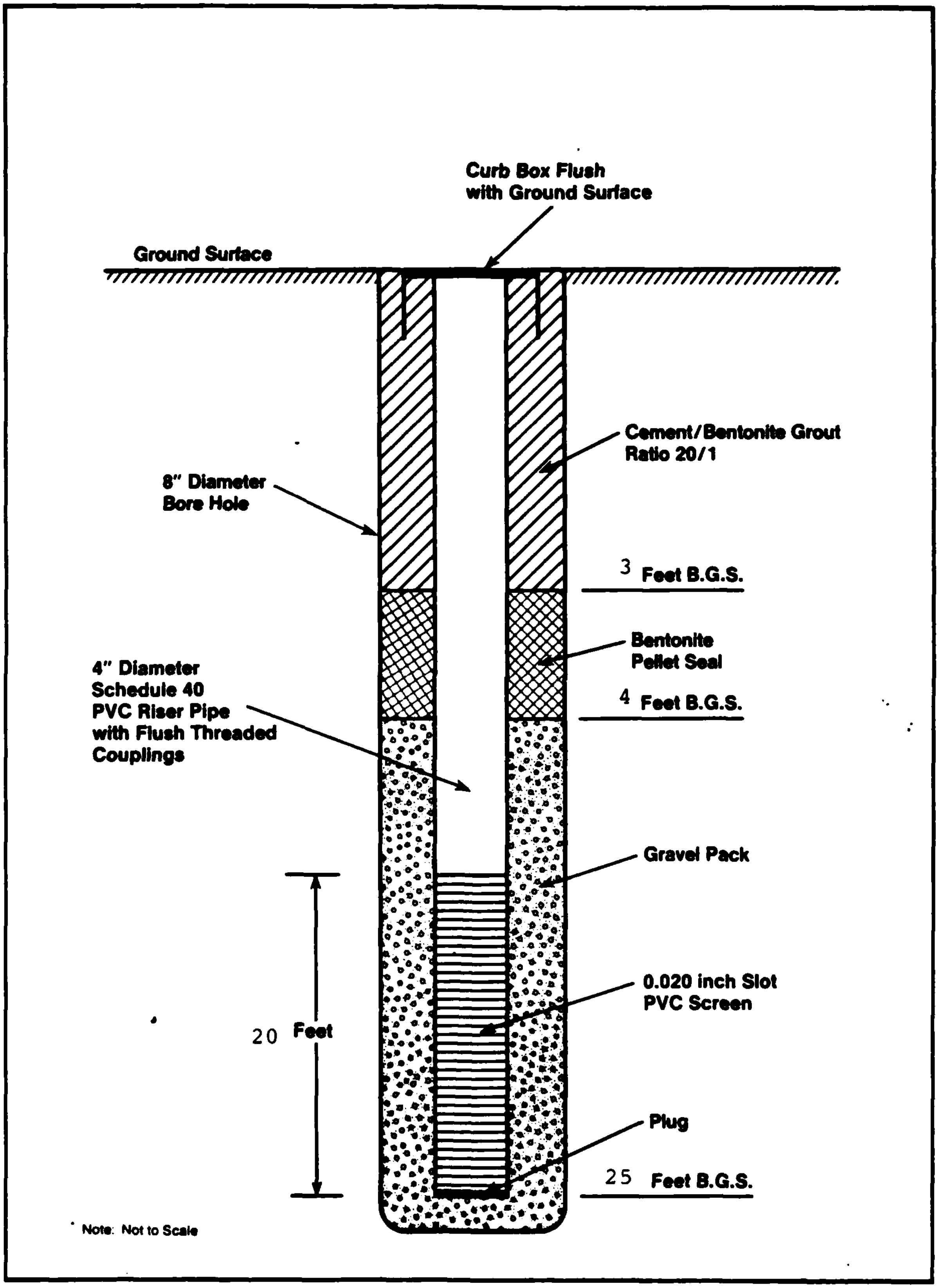
SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	6/5 5/4	0-2' Brown coarse to fine sand and silt, some fine gravel, moist, firm. Slight petrol odor.
5		2	SS	3/2 2/2	5-7' Same as above, loose
10		3	SS	7/5 4/2	10-12' Brown coarse to fine sand, little gravel and silt, damp, loose. Slight petrol odor.
15		4	SS	3/2 3/2	15-17' Same as above, some fine gravel, wet, loose
20		5	SS	10/18 9/9	20-22' Brown coarse to fine sand, fine to coarse gravel, saturated. Cobbles from 23.0-24.0'
25		6	SS	7/9 9/10	25-27' Gray silty coarse sand, some fine to coarse gravel, saturated
27					
30					

* A.S.T.M. D1586

SHEET ___ OF ___



WELL CONSTRUCTION LOG
WELL NUMBER 23

WESTON

DRILLING LOG

WELL NUMBER: MW-24
OWNER: U.S. Air Force
LOCATION: Parking lot / Noody St. beside building 3
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH: 27.0'
SURFACE ELEVATION:
WATER LEVEL: 11.8'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-9-84
DRILLER: A. Boutelle
HELPER: G. Stevens
LOG BY: J. Williams

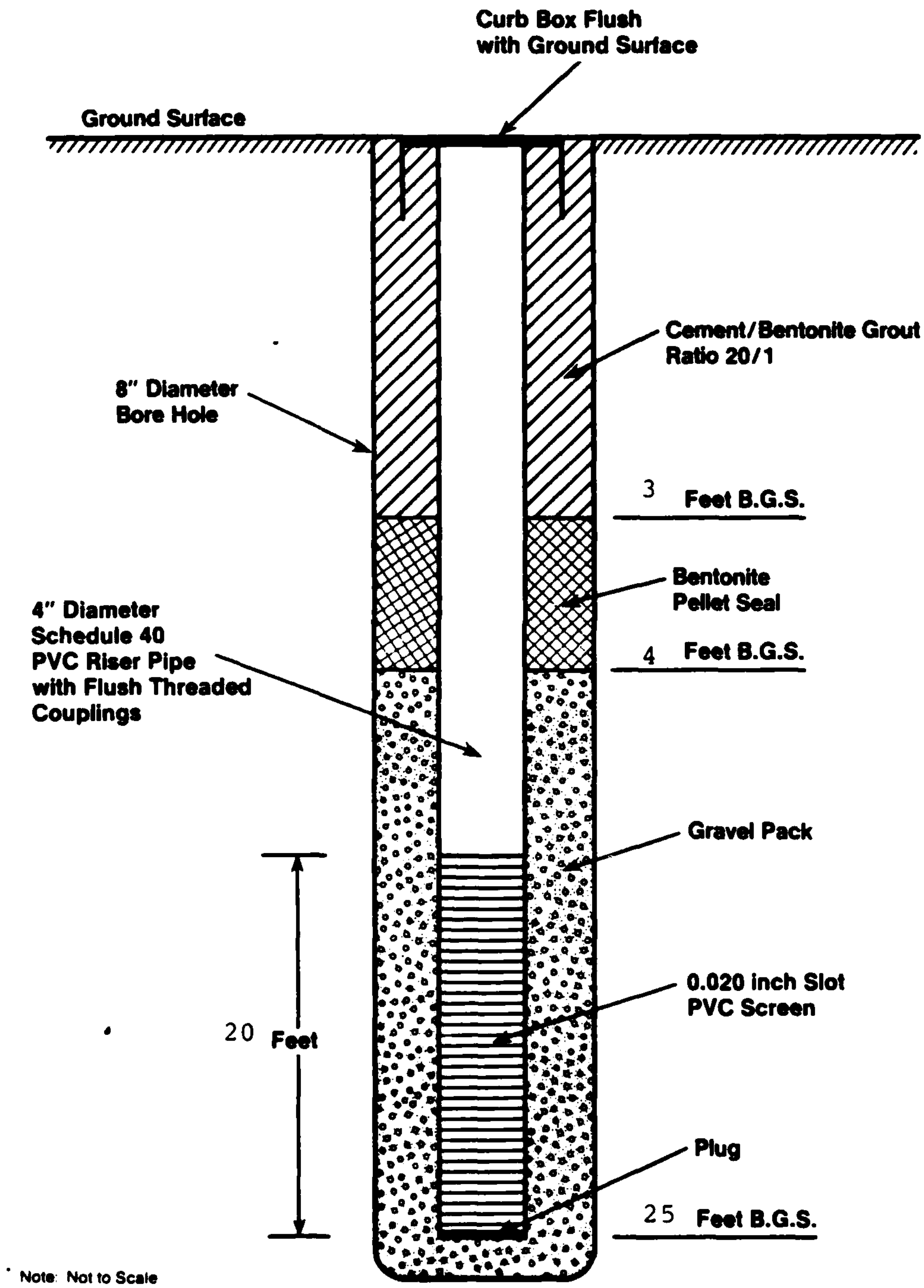
SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0			SS	—	0-2' Brown medium sand, fine to medium gravel, silt, loose
			SS	7 6 4 4	5-7' Dark brown fine to medium sandy silt, granular, slight odor
10		2	SS	2 1 1 1	10-12' Dark brown to black medium to coarse sand, some fine sandy silt, loose, wet
		3	SS	4 2 3 2	15-17' Brown medium to coarse sand, little fine sand and silt, loose and wet
20		4	SS	8 10 9 10	20-22' Brown fine to coarse sand and gravel, little silt, saturated, firm
27		5	SS	3 4 7 10	25-27' Greyish brown fine sand, some silt changing to grey, coarse to fine sand, little silt, saturated, firm

* A.S.T.M. D1586

SHEET ___ OF ___



WELL CONSTRUCTION LOG
WELL NUMBER 24

WESTON

DRILLING LOG

WELL NUMBER: MW-25
OWNER: U.S. Air Force
LOCATION:
ADDRESS: Griffiss AFB
Rome, NY
TOTAL DEPTH: 26.5'
SURFACE ELEVATION:
WATER LEVEL: 12.1'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-3-84
DRILLER: R. Bush
HELPER: A. Boutoille
LOG BY: D. Jones

SKETCH MAP

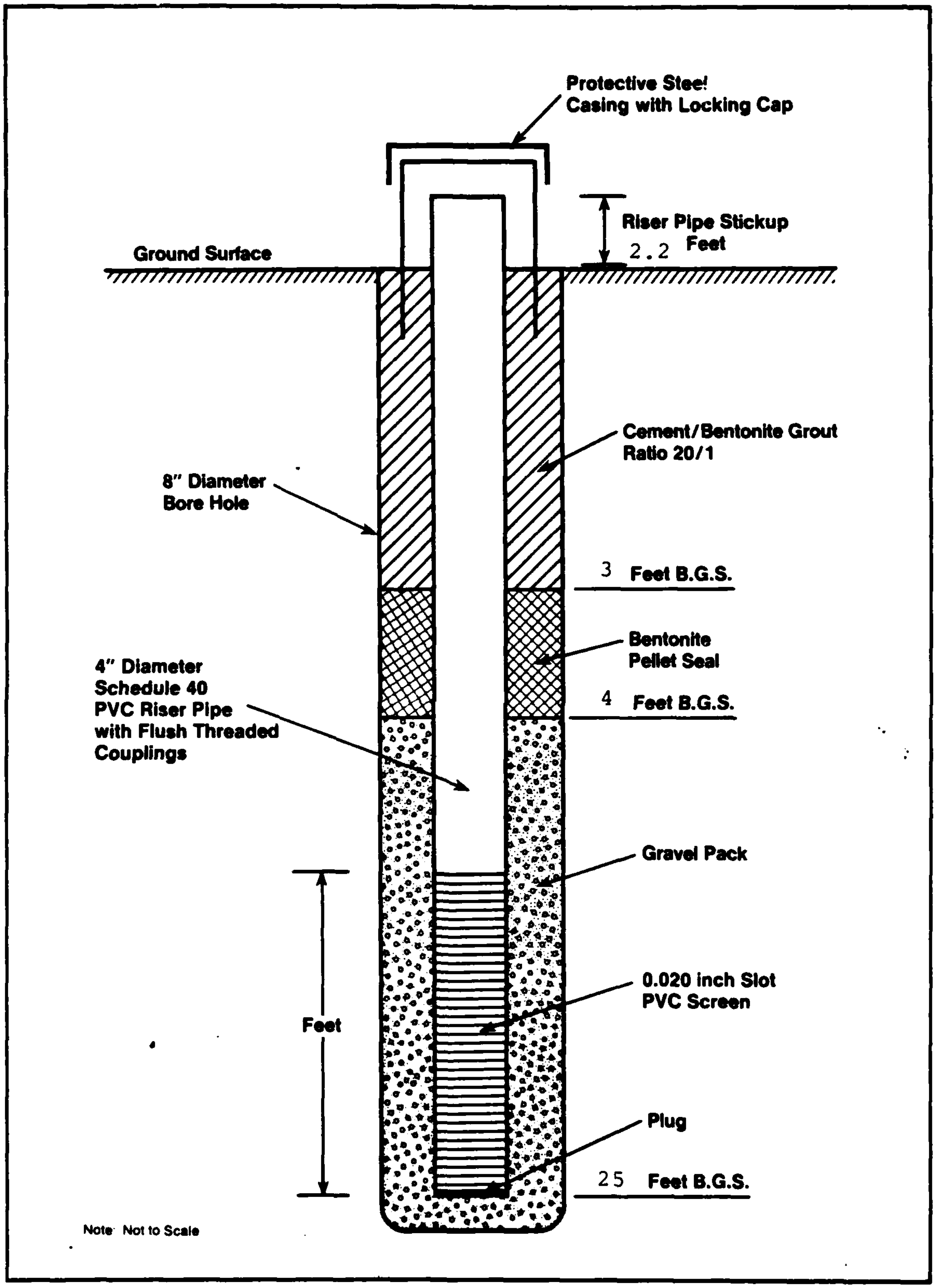
NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	2 12 13 14	0-2' Brown topsoil, fine to coarse sand, some silt, some gravel. Damp - loose.
5		2	SS	2 1 1 2	5-7' Brown fine to coarse sand, some silt, little gravel. Damp - loose.
10		3	SS	6 4 3 1	10-12' Yellowish brown to grey fine to medium sand, some silt. Damp - loose. Slight fuel odor.
15		4	SS	2 1 1 1	15-17' Brownish gray medium to coarse sand, some fine gravel, Wet - loose. Slight fuel odor
20		5	SS	4 7 8 15	20-22' Brown fine to coarse sand and fine gravel, little to trace silt, cobbles. Saturated - firm
25		6	SS	3 4 4 8	25-26.5' Brown fine sand, little silt. Saturated - loose.
30					

* A.S.T.M. D1586

SHEET 1 OF 1

WESTON



WELL CONSTRUCTION LOG
WELL NUMBER 25

ROY F. WESTON, INC.
WESTON
DESIGNERS CONSULTANTS

DRILLING LOG

WELL NUMBER: MW-26 OWNER: U.S. Air Force
LOCATION: Tank Farm Area East Side ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH 32.0'
SURFACE ELEVATION: WATER LEVEL: 14.9'
DRILLING COMPANY: Empire DRILLING METHOD: Auger DATE DRILLED: 7-3-84
DRILLER: R. Bush HELPER: A. Boutoille
LOG BY: J. Williams

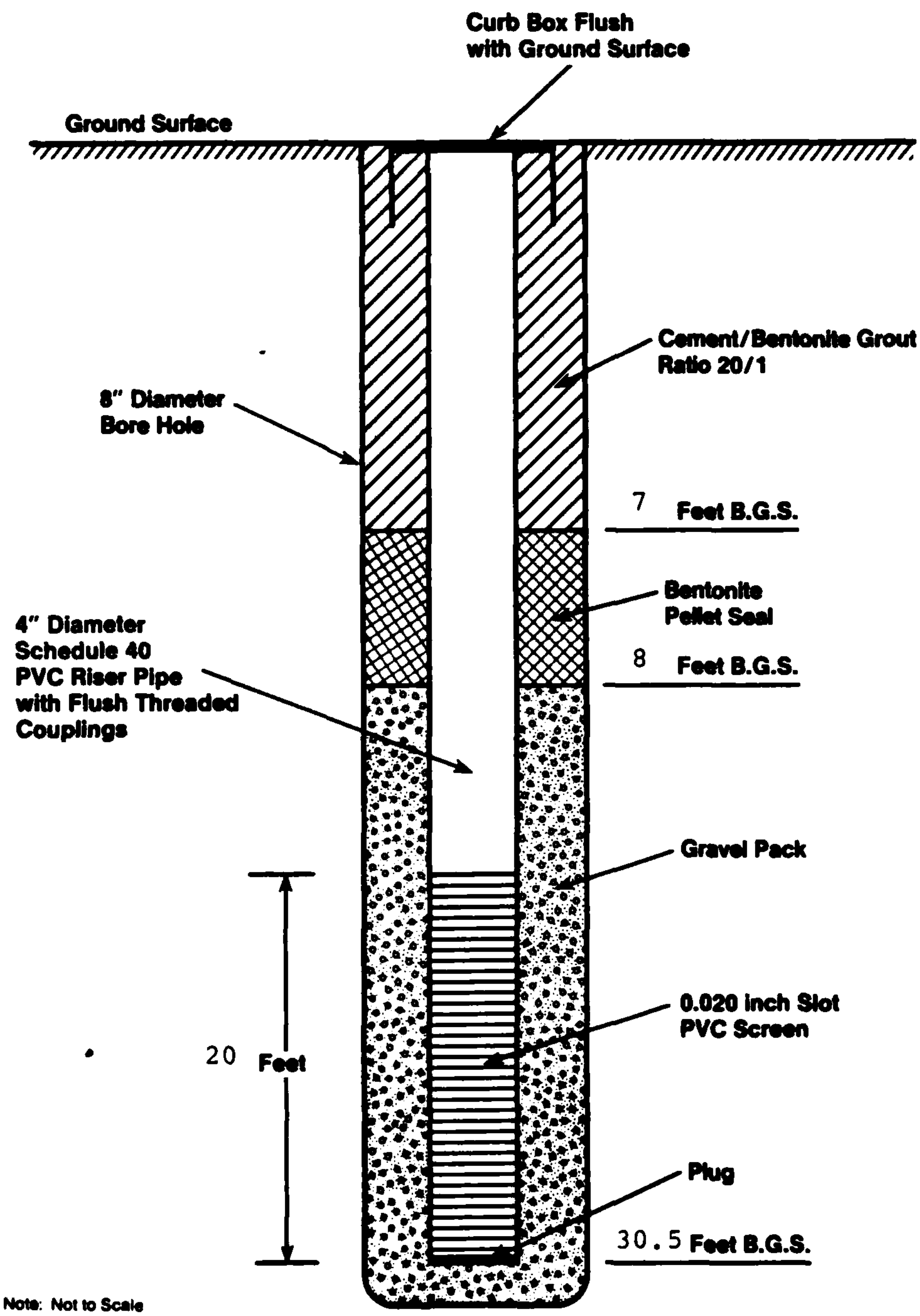
SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		—	—	—	0-2' No sample Concrete to 6"
5		1	SS	3 4 8 5	5-7' Dark brown fine to coarse sand, silt and gravel. Moist - firm. Cobbles.
10		2	SS	12 30 13 17	10-12' Brown fine to coarse sand and gravel, little silt. Damp - compact. cobbles.
15		3	SS	8 7 4 3	15-17' Grey fine to coarse sand, little gravel and silt. Wet and firm
20		4	SS	1 3 4 5	20-22' Brown fine sand, little silt. Saturated - loose
25		5	SS	3 3 4 4	25-27' Same as above
30		6	SS	5 5 10 32	30-32' Brown silt, little fine sand. Saturated - firm

* A.S.T.M. D1586

SHEET ____ OF ____



WELL CONSTRUCTION LOG
WELL NUMBER 26

ROY F. WESTON, INC.
WESTON
DESIGNERS CONSULTANTS

DRILLING LOG

WELL NUMBER: MW-27
OWNER: U.S. Air Force
LOCATION: Tank Farm Gas Pump Area north of tank farm
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH: 25.6'
SURFACE ELEVATION:
WATER LEVEL: 11.9'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-13-84
DRILLER: A. Boutoille
HELPER: G. Sievens
LOG BY: J. Williams

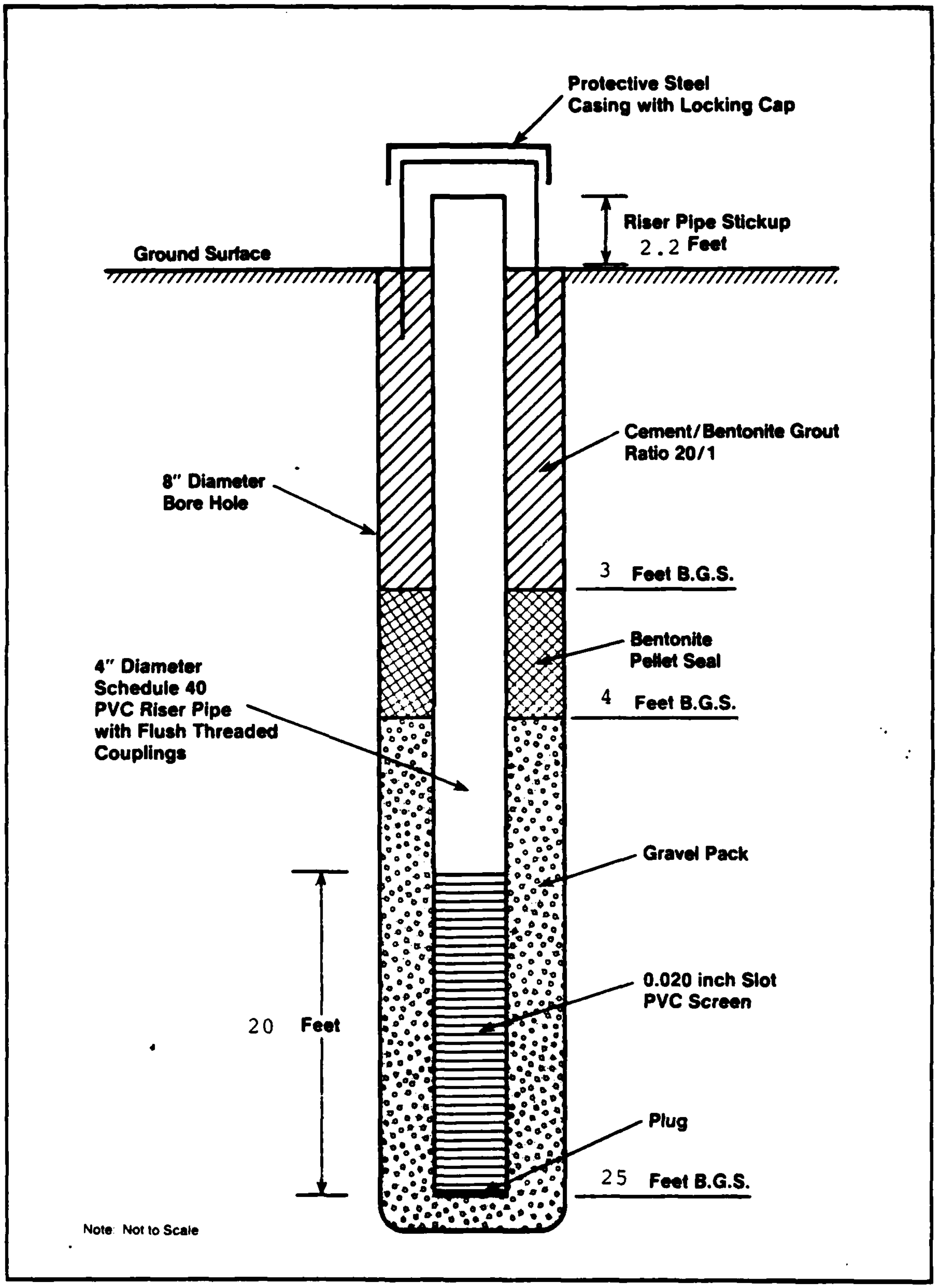
SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	5/12 20/25	0-2' Dark brown fine to coarse sandy silt
5		2	SS	12/8 8/6	5-7' Brown fine to coarse sand, some silt, fine to coarse gravel, loose, damp
10		3	SS	No Recov	10-12' Same as above
15		4	SS	3/3 4/3	15-17' Brown medium to coarse sand, little fine sand, silt, little fine to medium gravel, loose, wet
20		5	SS	12/18 50/70	20-22' Gray till, fine sandy silt, little gravel, moist, very compact
25		6	SS	60 100/0.1'	25-25.6' Gray till, some silt, some fine to medium sand, little fine to medium gravelly shale, damp.
30					

* A.S.T.M. D1586

SHEET ___ OF ___



WELL CONSTRUCTION LOG
WELL NUMBER 27

ROY F. WESTON, INC.
WESTON
DESIGNERS CONSULTANTS

DRILLING LOG

WELL NUMBER: MW-28
OWNER: U.S. Air Force
LOCATION:
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH: 26.3'
SURFACE ELEVATION:
WATER LEVEL: 11.5
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-9-84
DRILLER: A. Boutelle
HELPER: G. Stevens
LOG BY: J. Williams

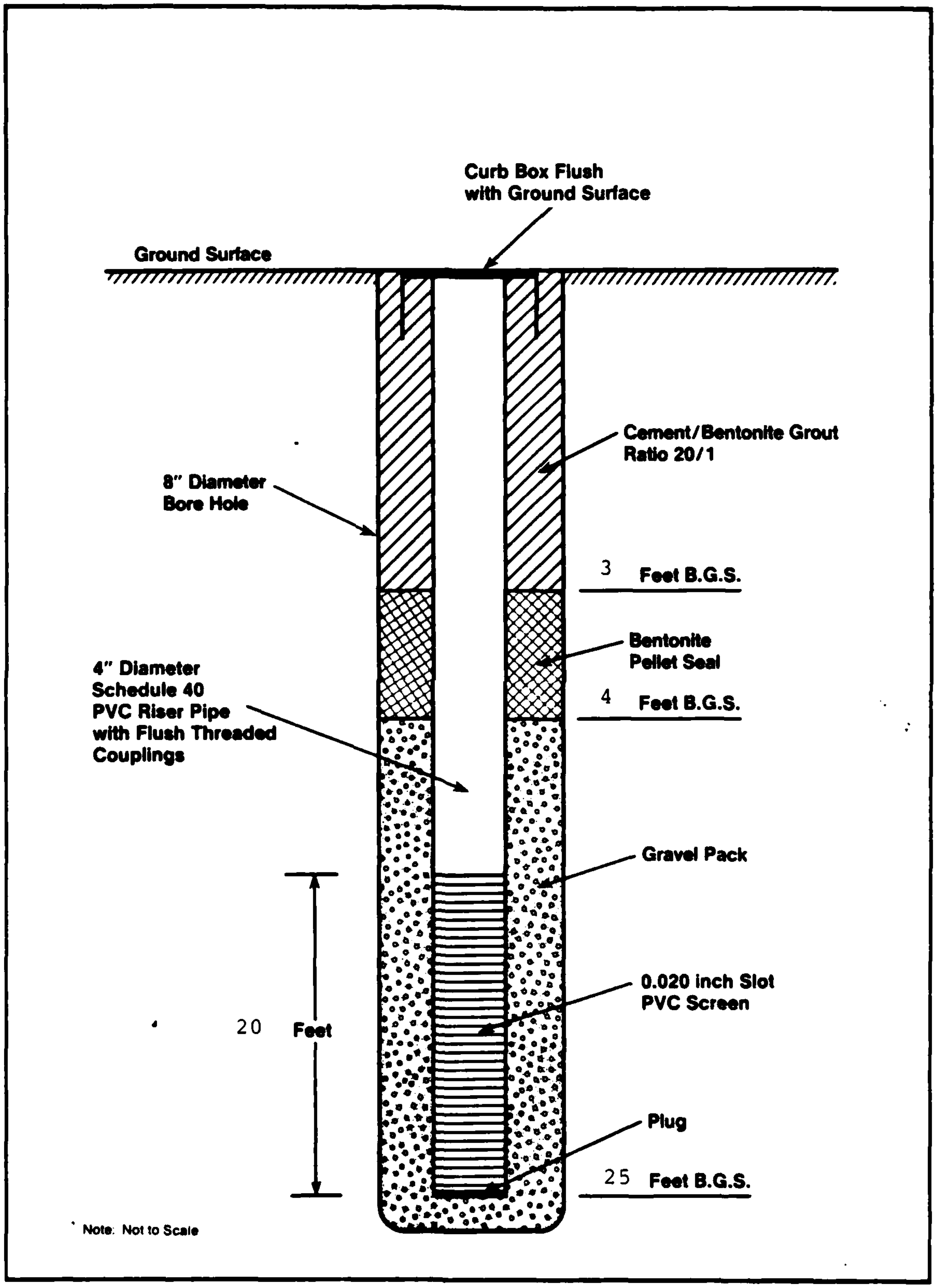
SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0					Boulders and cobbles to 1.0'
		1	SS	8 18 10 7	5-7' Brown fine to coarse sand and gravel, some silt, damp
10		2	SS	2 3 3 2	10-12' Brown medium to coarse sand, little silt, some fine gravel
		3	SS	3 1 2 2	15-17' Poor recovery, gravel fragments
20		4	SS	3 3 14 6	20-22' Brown fine to coarse sand and gravel, saturated, firm
26		5	SS	35 90 100 0.3	25-26.3' Grey silty sand, medium gravel, saturated

* A.S.T.M. D1586

SHEET ___ OF ___



WELL CONSTRUCTION LOG
WELL NUMBER 28

WESTON

DRILLING LOG

WELL NUMBER: MW-15 OWNER: U.S. Air Force
LOCATION: Landfill 7 Perimeter Road Griffiss Air Force Base ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH: 19.5'
SURFACE ELEVATION: WATER LEVEL: 6.4'
DRILLING COMPANY: Empire DRILLING METHOD: Auger DATE DRILLED: 6-25-84
DRILLER: Ron Bush HELPER: André Boutoille
LOG BY: R. Johnson

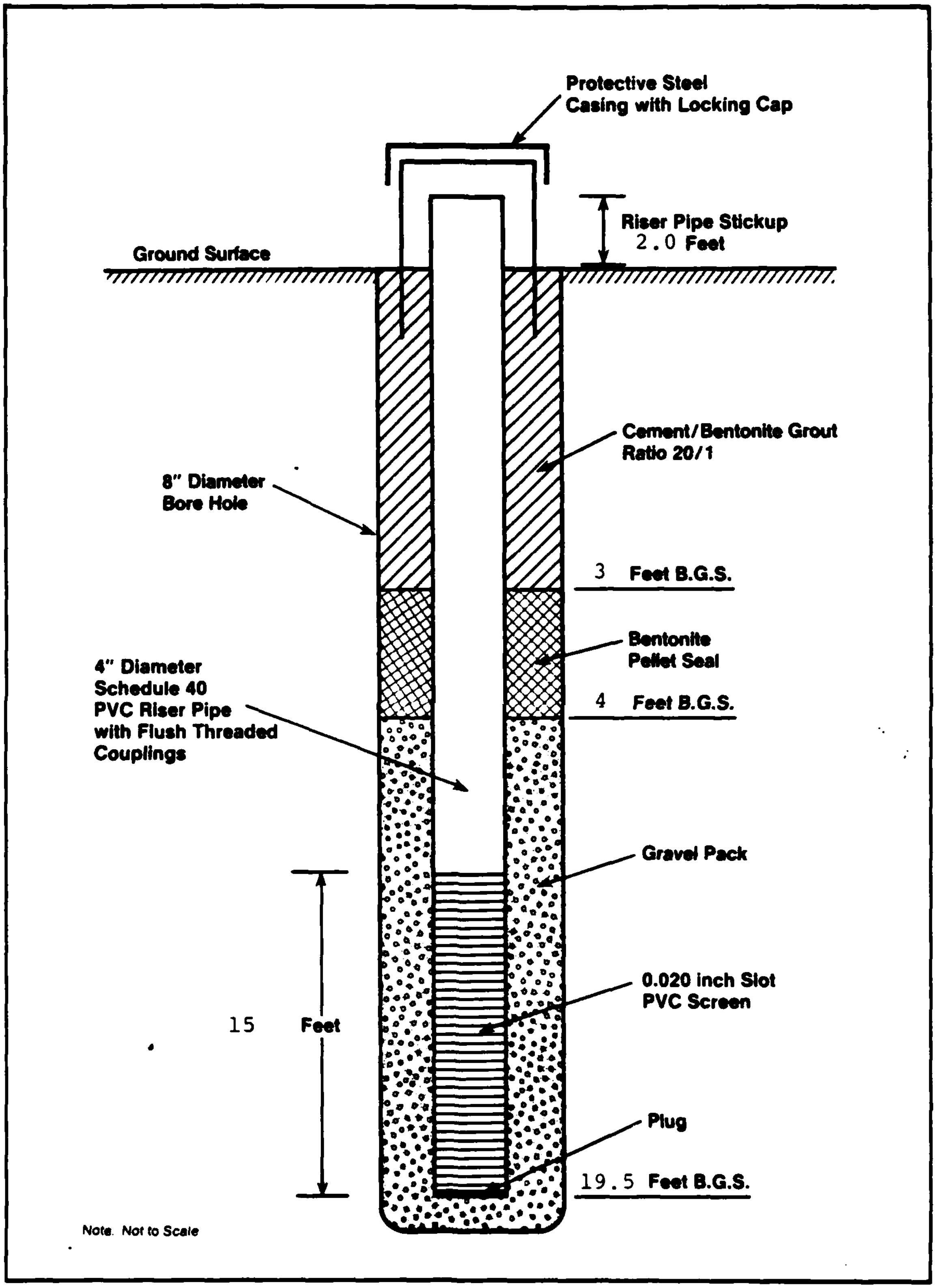
SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
		—	—	—	0-5' Light brown fine to medium sand, trace of silt, damp
		1	SS REC 1.00	6 8 12 14	5-7' Light brown fine to medium sand, trace of silt, moist to wet
		2	SS REC .75	4 10 12 17	10'-12' Same as above
		3	SS REC .75	3 4 5 7	15-17' Brown fine sand, wet
		4	SS REC 1.00	12 15 19 20	20-22' Grey, clayey till, shale fragments

* A.S.T.M. D1586

SHEET 1 OF 1



WELL CONSTRUCTION LOG
WELL NUMBER 15

WESTON

DRILLING LOG

WELL NUMBER: MW-16 OWNER: U.S. Air Force
LOCATION: Landfill 7, Perimeter Road, Griffiss Air Force Base
ADDRESS: Griffiss AFB, Rome, NY
TOTAL DEPTH: 23.0 FT
SURFACE ELEVATION:
WATER LEVEL: 8.0 FT
DRILLING COMPANY: Empire DRILLING METHOD: Auger DATE DRILLED: 6-26-89
DRILLER: Ron Bush HELPER: Andre Boutoille
LOG BY: D. Jones

SKETCH MAP

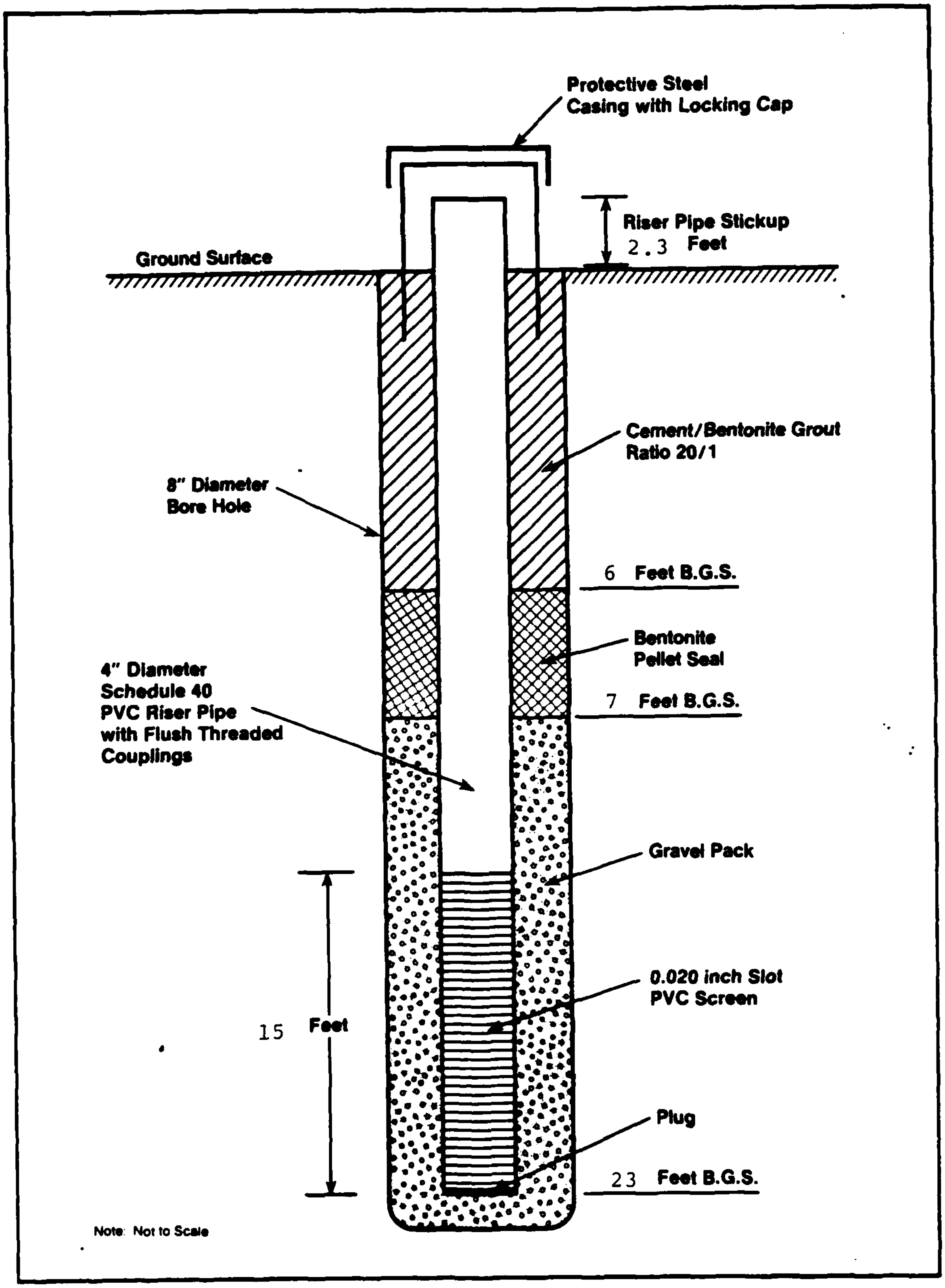
NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
		1	SS REC .83	2, 3, 3, 2	0-2' Topsoil, fill, fine sand and silt, brick and glass fragments, coal ash, dark gray to black
		2	SS REC .79	8, 41, 10, 3	5-7' Stony fill, dark gray to black, moist.
		3	SS REC .83	2, 1, 4, 7	10-12' Clayey sandy silt over medium to fine sand, reddish brown to brown, wet
		4	SS REC .67	1, 2, 3, 3	15-17' Fine to medium sand brown, wet
		5	SS REC .87	4, 3, 4, 4	20-22' Fine brown sand, wet
		6	SS	12, 21, 24, 25	25-27' Gray, clayey till, shale fragments Till started at 23.6'

* A.S.T.M. D1586

SHEET 1 OF 1

WESTON



WELL CONSTRUCTION LOG
WELL NUMBER 16

WESTON

DRILLING LOG

WELL NUMBER: MW-17
OWNER: U.S. Air Force
LOCATION: Landfill 7, Perimeter Road, Griffiss Air Force Base
ADDRESS: Griffiss AFB, Rome, NY
TOTAL DEPTH: 35.0'
SURFACE ELEVATION:
WATER LEVEL: 24.5'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 6-27-84
DRILLER: Ron Bush
HELPER: André Boutoille
LOG BY: D. Jones

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS REC .79	1 2 3 5	0-2' Light brown silt and fine sand, very uniform.
5		2	SS REC .75	4 18 17 14	5-7' Fine to medium sand and silt, moist, medium gravel, dark reddish brown
10		3	SS REC .92	4 5 5 7	10-12' Brown, medium sand, moist
15		4	SS REC .96	3 6 7 8	15-17' Brown, medium sand, dry
20		5	SS REC .87	8 10 11 12	20-22' Light brown fine sand, moist
25		6	SS REC .96	3 3 3 3	25-27' Light brown fine sand and silt, wet

* A.S.T.M. D1586

SHEET 1 OF 2

WESTON

DRILLING LOG

WELL NUMBER: MW-17 (cont'd)	OWNER:

LOCATION:	ADDRESS:

TOTAL DEPTH

SURFACE ELEVATION:	WATER LEVEL:

DRILLING COMPANY:	DRILLING METHOD:	DATE DRILLED:

DRILLER:	HELPER:

LOG BY: D. Jones

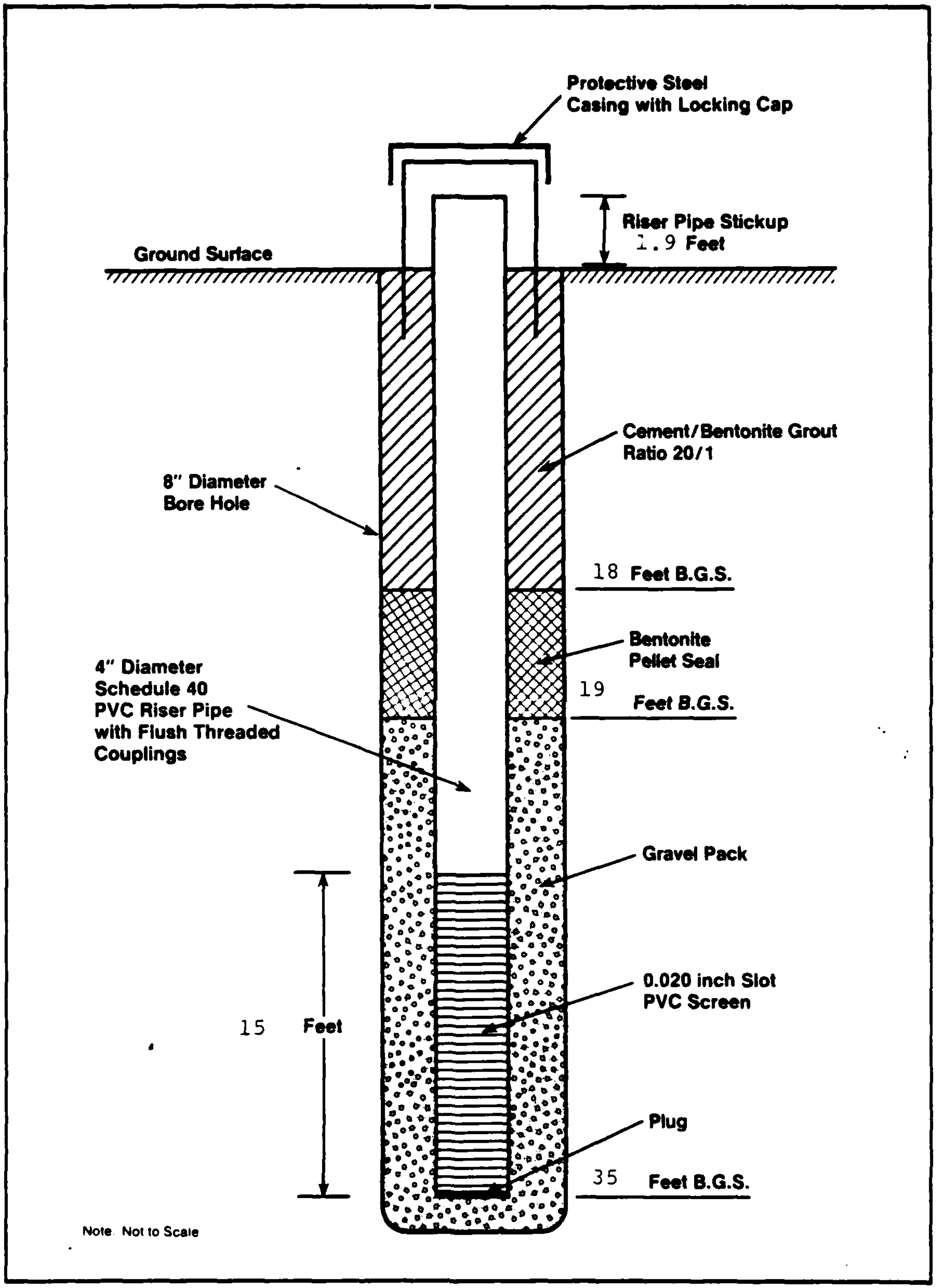
SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
		7	SS REC .87	5 7 8 10	30-32' Light brown fine clayey silt, wet
		8	SS REC .87	18 24 27 29	35-37' Clayey till, dark gray, wet

* A.S.T.M. D1586

SHEET 2 OF 2



WELL CONSTRUCTION LOG
WELL NUMBER 17

WESTON

DRILLING LOG

WELL NUMBER: MW-18 OWNER: U.S. Air Force
LOCATION: Landfill 7 Perimeter Rd. Griffiss Air Force Base ADDRESS: Griffiss Air Force Base Rome, NY
TOTAL DEPTH: 26.5'
SURFACE ELEVATION: WATER LEVEL: 11.9'
DRILLING COMPANY: Empire DRILLING METHOD: Auger DATE DRILLED: 6-28-84
DRILLER: Ron Bush HELPER: André Boutoille
LOG BY: D. Jones

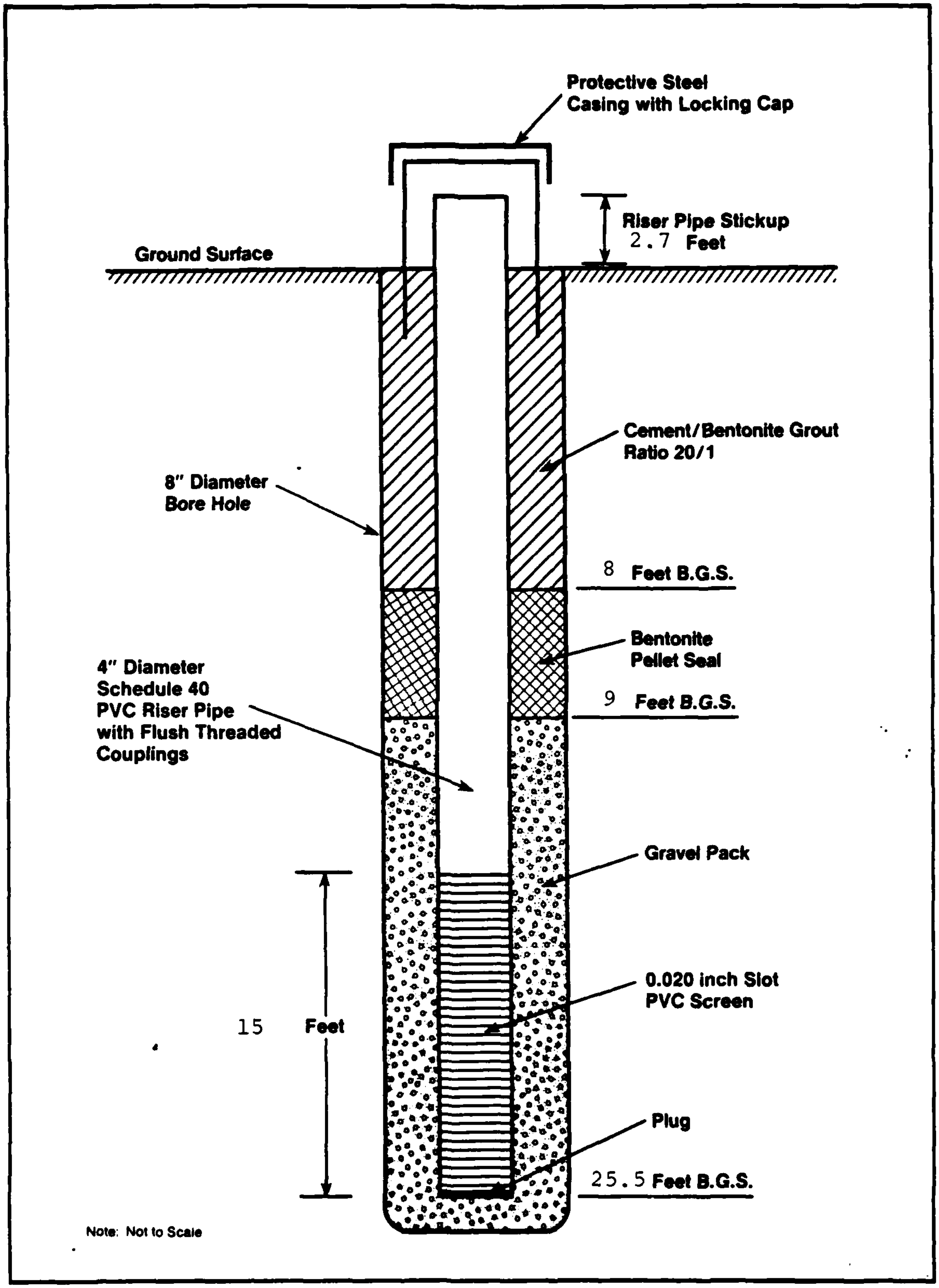
SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
		1	SS REC .87	1 2 2 4	0-2' Light brown fine to medium sand, moist, trace of silt. About 0.2' topsoil
		2	SS REC .75	2 3 3 4	5-7' Same as above
		3	SS REC .79	3 3 3 3	10-12' Brown fine to medium sand, moist to wet.
		4	SS REC .79	1 2 2 3	15-17' Brown fine sand, wet
		5	SS REC .83	4 6 8 9	20-22' Same as above
		6	SS REC .88	3 7 12 16	25-27' Gray clayey till, wet, gravel up to 1/2" diameter

* A.S.T.M. D1586

SHEET 1 OF 1



WELL CONSTRUCTION LOG
WELL NUMBER 18

ROY F. WESTON, INC.
WESTON
DESIGNERS CONSULTANTS

DRILLING LOG

WELL NUMBER: MW-19 OWNER: U.S. Air Force
LOCATION: Building 210 ADDRESS: Griffiss AFB, Rome, NY
TOTAL DEPTH 32.0'
SURFACE ELEVATION: ______ WATER LEVEL: 18.0'
DRILLING COMPANY: Empire DRILLING METHOD: Auger DATE DRILLED: 7-16-88
DRILLER: A. Boutoille HELPER: G. Stevens
LOG BY: J. Williams

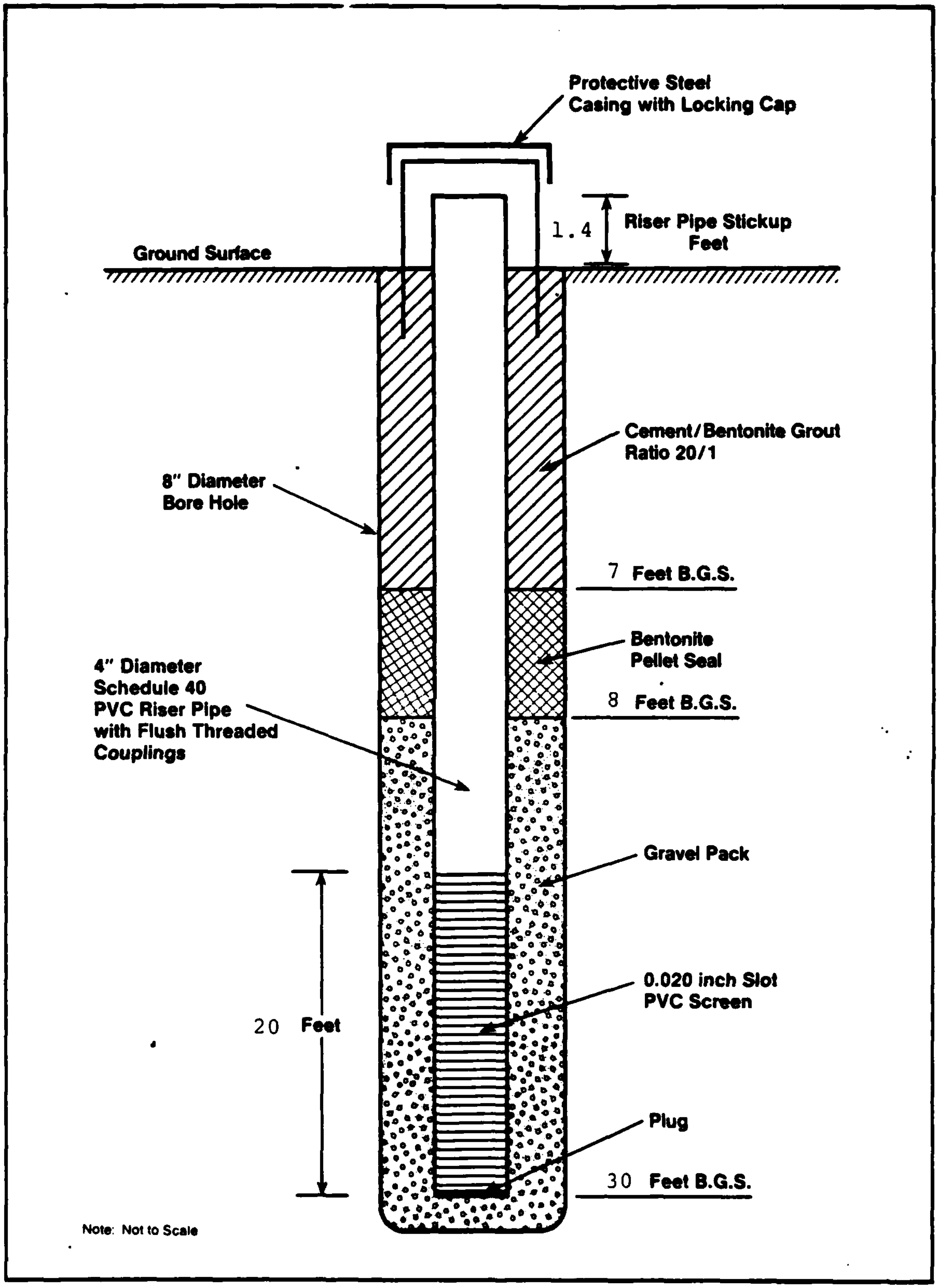
SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	3 12 10 19	0-2' Brown coarse to fine sand, silt & gravel. Damp and firm.
5		2	SS	15 9 6 6	5-7' No recovery - coarse gravel blocked spoon.
10		3	SS	7 6 6 6	10-12' Brown coarse to fine sand and gravel some silt. Damp and firm
15		4	SS	5 3 7 12	15-17' Brown medium to fine sand little to trace silt with seams of gravel. Wet and firm
20		5	SS	4 8 ~~35~~ 35	20-22' Same as above, compact
25		6	SS	31 11 8 8	25-27' Brown coarse to fine sand, some fine gravel, little silt and clay
30		7	SS	14 21 11 12	30-32' Grey silty clay, wet.
32					

* A.S.T.M. D1586

SHEET ____ OF ____



WELL CONSTRUCTION LOG
WELL NUMBER 19

WESTON

DRILLING LOG

WELL NUMBER: BP-1
OWNER: U.S. Air Force
LOCATION: Building 101 Griffiss Air Force Base Battery acid pit
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH 8.0'
SURFACE ELEVATION:
WATER LEVEL: —
DRILLING COMPANY: Empire
DRILLING METHOD: Tripod and Hammer
DATE DRILLED: 7-5-84
DRILLER:
HELPER:
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	1	0-2' Greenish gray fine to medium sandy silt, wet, battery sludge
2		2	SS	3 6 4 5	2-4' Same as above
4		3	SS	8 11 16 32	4-6' Same as above
6		4	SS	10 40 15 15	6-8' Grayish brown silty fine to coarse sand, fine to coarse gravel, wet natural soil
8					

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: BP-2 OWNER: U.S. Air Force
LOCATION: Building 222 Battery acid pit Griffiss Air Force Base ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH: 12.0'
SURFACE ELEVATION: WATER LEVEL: —
DRILLING COMPANY: Empire DRILLING METHOD: Auger DATE DRILLED: 7-5-84
DRILLER: HELPER:
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	1, 1, 1, 2	0-2' Greenish gray silty fine to medium sandy sludge. 1" thick band of orange/brown silty sand at 6" depth
2		2	SS	15, 17, 30, 23	2-4' Greenish gray silty fine to medium sand, fine to medium gravel
4		3	SS	35, 30, 20, 27	4-6' Greenish gray silty fine to medium sand, some hardened carbonate
6		4	SS	16, 21, 20, 19	6-8' Dark greenish gray fine to medium sand, little silt, little fine to medium gravel. Hardened carbonate.
8		5	SS	15, 15, 6, 6	8-10' Dark greenish gray silty fine to coarse sand, little fine to coarse gravel, damp
10		6	SS	9, 11, 13, 8	10-12' Grayish brown fine to coarse sand, little coarse gravel, damp, clean soil
12					

* A.S.T.M. D1586

SHEET ____ OF ____

WESTON

DRILLING LOG

WELL NUMBER: TB-1 OWNER: U.S. Air Force

LOCATION: Gas Pump Area ADDRESS: Griffiss AFB Rome, NY

TOTAL DEPTH 17.0'

SURFACE ELEVATION: WATER LEVEL: 14.2'

DRILLING COMPANY: Empire DRILLING METHOD: Auger DATE DRILLED: 6-27-89

DRILLER: HELPER:

LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	5 12 20 25	0-2' Dark brown fine to coarse sandy silt
5		2	SS	12 8 8 6	5-7' Brown fine to coarse sand, some silt, fine to coarse gravel, loose, damp
10		3	SS	5 4 3 3	10-12' Same as above
15		4	SS	3 3 4 3	15-17' Brown med to coarse sand, little fine sand, silt, little fine to medium gravel, loose, wet

* A.S.T.M. D1586

SHEET 1 OF 1

WESTON

DRILLING LOG

WELL NUMBER: TB-2
OWNER: US Air Force
LOCATION:
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH: 17.0'
SURFACE ELEVATION:
WATER LEVEL: 10.7'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 6-27-84
DRILLER:
HELPER:
LOG BY: V. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
		1	SS	2 5 5 5	0-2' Brown topsoil, fine sandy silt, damp cohesive, some fine gravel
		2	SS	7 11 11 7	5-7' Brown fine to coarse sandy silt, some fine gravel, damp, loose
		3	SS	5 6 4 4	10-12' Brown fine to coarse sand, some fine to medium gravel, some silt, loose, wet
		4	SS	3 9 4 4	15-17' Same as above

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-3
OWNER: U.S. Air Force
LOCATION: Grassy area behind tank Farm
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH: 17.0'
SURFACE ELEVATION:
WATER LEVEL: 13.1'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 6-27-84
DRILLER:
HELPER:
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
		1	SS	4 7 16 18	0-2' Brown topsoil, fine sandy silt, damp, some fine gravel.
		2	SS	4 4 4 10	5-7' Brown fine to coarse sandy silt, some fine to medium gravel, damp.
		3	SS	20 36 9 16	10-12' Brown fine to coarse sand, some fine to medium gravel, little silt loose, damp.
		4	SS	1 1 2 2	15-17' Brown fine to coarse sand, little silt, some fine gravel wet loose.

* A.S.T.M. D1586

SHEET ____ OF ____

WESTON

DRILLING LOG

WELL NUMBER: TE-4
OWNER: U.S. Air Force
LOCATION:
ADDRESS: Griffiss AFB
Rome, NY
TOTAL DEPTH: 17.0'
SURFACE ELEVATION:
WATER LEVEL: 9.2'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 6-26-84
DRILLER:
HELPER:
LOG BY: J Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	4 10	0-2' Brown fine to coarse sand, silt and
				11 7	gravel. Moist - firm
5		2	SS	11 10	5-7' Same as above
				10 12	
10		3	SS	13 10	10-12' Poor recovery - coarse gravel blocked
				7 7	spoon
15		4	SS	4 3	15-17' Brown fine to coarse sand and fine
				2 3	gravel, little to trace silt, saturated -
					loose.

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-5 OWNER: U.S. Air Force
LOCATION: Tank Farm ADDRESS: Griffiss AFB
Rome, NY
TOTAL DEPTH 17.0'
SURFACE ELEVATION: WATER LEVEL: 11.3'
DRILLING COMPANY: Empire DRILLING METHOD: Auger DATE DRILLED: 7-2-84
DRILLER: HELPER:
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	15 9 12 18	0-2' Tan silt and dark brown organic silt, little sand, Moist, firm
5		2	SS	12 12 7 7	5-7' Brown/Grey fine sand, some silt, trace of gravel. Wet, firm, fuel odor
10		3	SS	5 7 4 7	10-12' Little recovery - gravel
15		4	SS	11 9 7 7	15-17' Brown fine to coarse sand and fine gravel, little silt, saturated firm
17					

* A.S.T.M. D1586

SHEET 1 OF 1

WESTON

DRILLING LOG

WELL NUMBER: TB-6
OWNER: U.S. Air Force
LOCATION:
ADDRESS: Griffiss AFB
Rome, NY
TOTAL DEPTH 17.0'
SURFACE ELEVATION:
WATER LEVEL: 11.3
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 10-26-84
DRILLER:
HELPER:
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	7 9 21 26	0-2' Brown fine to coarse sand, silt and gravel. Moist - firm
5		2	SS	4 3 3 4	5-7' Same as above
10		3	SS	7 6 9 9	10-12' No Recovery.
15		4	SS	3 2 2 2	15-17' Brown fine to coarse sand, some fine gravel, little silt, Saturated - loose

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-7
OWNER: U S Air Force
LOCATION: Tank Farm Area, north side of tanks
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH: 17.0'
SURFACE ELEVATION:
WATER LEVEL: 10.8'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-2-84
DRILLER:
HELPER:
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	12 10 13 14	0-2' Brown fine to coarse sand, silt and fine gravel, moist, firm
5		2	SS	6 7 8 7	5-7' Same as above
10		3	SS	3 2 2 2	10-12' Brown fine to medium sand, some silt and gravel, wet and loose
15		4	SS	3 4 9 26	15-17' Brown fine to coarse sand and gravel little silt, saturated, firm
17					

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-8 OWNER: U.S Air Force
LOCATION: ADDRESS: Griffiss AFB
Rome, NY
TOTAL DEPTH 17.0'
SURFACE ELEVATION: WATER LEVEL: 11.8'
DRILLING COMPANY: Empire DRILLING METHOD: Auger DATE DRILLED: 6-28-84
DRILLER: HELPER:
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
		1	SS	7 11 16 8	0-2' Dark brown top soil, sandy silt, cohesive, damp
		2	SS	11 11 7 7	5-7' Black to brown granular sandy silt, loose, damp, slight fuel odor.
		3	SS	11 4 3 2	10-12' Light brown silty sand, wet, some gravel
		4	SS	7 12 13 17	15-17' Light brown silty fine to coarse sand, some fine to medium gravel, wet, loose

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON
DESIGNERS CONSULTANTS

DRILLING LOG

WELL NUMBER: TB-9
OWNER: U.S. Air Force
LOCATION: Adjacent to the west side of berm around tanks in Tank Farm Area
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH 17.0'
SURFACE ELEVATION:
WATER LEVEL: 13.3'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 6-27-84
DRILLER:
HELPER:
LOG BY: J Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
		1	SS	13 27 14 7	0-2' Brown to black med to coarse sand, some silt, some fine to medium gravel. Loose
		2	SS	14 14 12 12	5-7' Brown fine to medium sandy silt, little coarse sand, little fine to medium gravel, loose.
		3	SS	5 5 8 7	10-12' Dark brown granular fine to medium sandy silt, some fine to medium gravel, loose, damp
		4	SS	5 7 7 10	15-17' Dark brown fine to coarse sand, moderate silt, some fine to medium gravel, wet

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-10
OWNER: U.S. Air Force
LOCATION: Tank Farm
ADDRESS: Griffiss AFB, Rome, NY
TOTAL DEPTH: 17.0'
SURFACE ELEVATION:
WATER LEVEL: 13.0'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-3-84
DRILLER:
HELPER:
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	10 7 4 2	0-2' Black/Brown fine to course sand, silt and gravel. Damp - firm. Slight fuel odor.
5		2	SS	15 24 34 16	5-7' Brown fine to coarse sand and gravel, some silt. Damp, very compact. Slight fuel odor.
10		3	SS	15 10 9 4	10-12' No Recovery - Coarse Gravel in spoon
15		4	SS	2 3 3 7	15-17' Brown fine to medium sand, little silt. Saturated - loose.
17					

* A.S.T.M. D1586

SHEET ____ OF ____

WESTON

DRILLING LOG

WELL NUMBER: TB-11 OWNER: U.S. Air Force
LOCATION: Tank Farm ADDRESS: Griffiss AFB
Rome, NY
TOTAL DEPTH 17.0'
SURFACE ELEVATION: WATER LEVEL: 11-8'
DRILLING COMPANY: Empire DRILLING METHOD: Auger DATE DRILLED: 7-2-84
DRILLER: HELPER:
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	27 15 18 11	0-2' Dark brown silty fine to medium sand, little fine gravel. Strong odor
5		2	SS	13 16 17 18	5-7' No recovery - coarse gravel blocked spoon.
10		3	SS	3 2 3 3	10-12' Brown fine to coarse sand, some fine gravel, little silt, wet, loose
15		4	SS	21 29 27 24	15-17' Brown silty fine to coarse sand and gravel, wet, loose

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB 12
OWNER: U.S. Air Force
LOCATION: Tank Farm Area
ADDRESS: Griffiss AFB
Rome, NY
TOTAL DEPTH 17.0'
SURFACE ELEVATION:
WATER LEVEL: 10.0'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-2-84
DRILLER: John
HELPER: Glenn
LOG BY: D Jones

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
		1	SS	3 10	0-2' Brown medium sand and silt, moist
			REC .29	9 5	
		2	SS	14 17	5-7' Brown fine to coarse sand, fine to
			REC .21	10 11	coarse gravel, moist
		3	SS	5 5	10-12' Brown fine to medium sand, silt, wet
			REC .33	5 7	
		4	SS	3 2	15-17' Same as above
			REC .33	3 4	

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-13
OWNER: U.S. Air Force
LOCATION: Tank Farm Area
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH 17.0'
SURFACE ELEVATION:
WATER LEVEL: 11.2'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-2-84
DRILLER: John
HELPER: Glenn
LOG BY: D. Jones

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
		1	SS	8	0-2' Brown medium sand over light brown
			REC	10	fine sand and silt, moist
			.75	10	
				16	
		2	SS	4	5-7' Brown medium sand and fine gravel
			REC	3	coarse gravel intermixed. Coarse gravel
			.12	3	in end of spoon caused poor recovery.
				3	
		3	SS	6	10-12' Brown fine to coarse sand and silt,
			REC.	7	fine gravel, wet
			.17	4	coarse gravel intermixed 10-15'
				3	
		4	SS	3	15-17' Brown fine to coarse sand, wet,
			REC	3	slight fuel odor
			.50	3	
				4	

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-14
OWNER: U.S. Air Force
LOCATION:
ADDRESS: Griffiss AFB
Rome, Ny
TOTAL DEPTH 12.0'
SURFACE ELEVATION:
WATER LEVEL: 10.5'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-2-84
DRILLER:
HELPER:
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	14 16 10 10	0-2' Brown silty fine to coarse sand, little fine to coarse gravel. Loose damp
5		2	SS	3 3 3 3	5-7' Same as above. Strong fuel odor
10		3	SS	2 1 1 1	10-12' Grey fine to coarse sand and fine gravel, little silt. Wet-loose
15		4	SS	3 4 4 6	15-17' Brown fine sand, some silt

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TS-15
OWNER: U.S. Air Force
LOCATION: Tank Farm Area
ADDRESS: Griffiss Air Force Base
Rome NY
TOTAL DEPTH 17.0'
SURFACE ELEVATION:
WATER LEVEL: 10.6'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-2-84
DRILLER: John
HELPER: Glenn
LOG BY: D. Jones

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
		1	SS	2 8	0-2' Brown, fine to medium sand, silt and
			REC .42	7 13	coarse gravel
		2	SS	6 5	5-7' Same as above, moist, slight gasoline
			REC .13	7 8	odor
		3	SS	4 3	10-12' Same as above, but wet, no odor.
			REC .16	3 3	
		4	SS	10 11	15-17' Brown fine to coarse sand, trace
			REC .50	4 14	of silt, wet, medium gravel

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-16
OWNER: U.S. Air Force
LOCATION:
ADDRESS: Griffiss AFB, Rome, NY
TOTAL DEPTH: 17.0'
SURFACE ELEVATION:
WATER LEVEL: 12.5'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-3-84
DRILLER:
HELPER:
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	13 21 16 12	0-2' Brown fine to coarse sand, silt and Gravel Damp, compact
5		2	SS	9 10 9 9	5-7' Same as above, firm
10		3	SS	5 12 11 5	10-12' Grey/Brown fine to coarse sand, little fine gravel and silt. Moist and firm
15		4	SS	2 1 2 4	15-17' Grey fine sand, little silt with gravelly seams. Saturated - loose.
17					

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-17
OWNER: U.S. Air Force
LOCATION: Tank Farm Area East side
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH: 18.0'
SURFACE ELEVATION:
WATER LEVEL: 15.0'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-2-84
DRILLER:
HELPER: G. Stevens
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		—	—	—	0-2' No sample. Concrete to 6"
5.		1	SS	3 4 8 5	5-7' Dark brown fine to coarse sand, silt and gravel, moist and firm. Cobbles
10		2	SS	12 20 13 17	10-12' Brown fine to coarse sand and gravel, little silt. Damp, compact Cobbles.
15		3	SS	8 7 4 3	15-17' Grey fine to coarse sand, little gravel and silt. Wet and firm
18					
20					

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-18
OWNER: U.S. Air Force
LOCATION: Tank Farm Area
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH: 17.0'
SURFACE ELEVATION:
WATER LEVEL: 14.0'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-2-84
DRILLER: John
HELPER: Glenn
LOG BY: D. Jones

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
		1	SS	9	
				6	0-2' Brown fine to coarse sand, silt
			REC	9	fine gravel, moist
			.42	2	
		2	SS	7	
				10	5-7' Brown fine to coarse sand, silt, some
			REC	14	clay, moist, coarse gravel intermixed
			.50	15	
		3	SS	12	
				15	10-12' Brown fine to coarse sand, silt, moist
			REC	4	
			.25	3	
		4	SS	1	
				1	15-17' Brown fine to coarse sand, wet,
			REC	1	strong fuel odor
			.37	1	

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-19
LOCATION: Tank Farm Area
SURFACE ELEVATION:
DRILLING COMPANY: Empire
DRILLER:
LOG BY: D. Jones

OWNER: U.S. Air Force
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH: 16.5'
WATER LEVEL: 12.6'
DRILLING METHOD: Auger
DATE DRILLED: 7-2-84
HELPER:

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	12 9 7 7	0-2' Dark brown silty sand, fine gravel, slight fuel odor
5		2	SS	18 20 18 10	5-7' Brown fine to coarse sand, trace of silt, fine to coarse gravel
10		3	SS	7 7 9 12	10-12' Brown fine to coarse sand, some reddish clay, slight fuel odor
15		4	SS	2 4 23	15-16.5' Brown fine to coarse sand, some silt fine gravel, wet

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-20 OWNER: U.S. Air Force

LOCATION: ADDRESS:

TOTAL DEPTH: 14.0'

SURFACE ELEVATION: WATER LEVEL: 12.7'

DRILLING COMPANY: Empire DRILLING METHOD: Auger DATE DRILLED: 7-2-84

DRILLER: J. HELPER: G. Stevens

LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	12 7 7 18	0-2' Dark brown granular sandy silt, fine to medium gravel, loose, damp
5		2	SS	9 13 10 12	5-7' Brown silty fine to coarse sand, some fine to coarse gravel, loose
10		3	SS	4 3 3 2	10-12' Grey/Brown silty fine to coarse sand, some fine to medium gravel. Loose - damp. Strong fuel odor
15		4	SS	9 8 8 8	15-17' Grey/Brown fine to coarse sand, trace silt, some fine to medium gravel. Wet - loose. Strong fuel odor

* A.S.T.M. D1586

SHEET ____ OF ____

WESTON

DRILLING LOG

WELL NUMBER: TB-21
LOCATION:
SURFACE ELEVATION:
DRILLING COMPANY: Empire
DRILLER:
LOG BY: J. Williams

OWNER: U.S. Air Force
ADDRESS: Griffiss AFB
Rome, NY
TOTAL DEPTH: 17.0'
WATER LEVEL: 11.8'
DRILLING METHOD: Auger
HELPER:
DATE DRILLED: 6-26-84

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
		1	SS	2 12 13 14	0-2' Brown topsoil, fine to coarse sand, some silt, some gravel, damp, loose.
		2	SS	2 1 1 2	5-7' Brown fine to coarse sand, some silt, little gravel, damp, loose
		3	SS	6 4 3 1	10-12' Yellowish brown to grey fine to medium sand, some silt, damp, loose Slight odor
		4	SS	2 1 1 1	15-17' Brownish gray medium to coarse sand, some fine gravel, wet, loose Slight odor

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-22
OWNER: U.S. Air Force
LOCATION:
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH: 17.0'
SURFACE ELEVATION:
WATER LEVEL: 13.2'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 6-26-84
DRILLER:
HELPER:
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
		1	SS	2 7 15 19	0-2' Brown topsoil, sandy silt, damp, little black slag
		2	SS	14 13 11 8	5-7' Brown sandy silt, some gravel, loose
		3	SS	3 2 3 2	10-12' Dark gray fine to coarse sand, some silt, loose, damp. Strong fuel odor.
		4	SS	1 1 1 2	15-17' Dark gray fine to coarse sand, some silt, wet. Moderate fuel odor.

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-23
OWNER: U.S. Air Force
LOCATION: In front of RR tracks on Brooks Rd., near Tank Farm area.
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH: 17.0'
SURFACE ELEVATION:
WATER LEVEL: 12.1'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 6/25/84
DRILLER: John
HELPER: Glenn
LOG BY: D. Jones

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
		1	SS REC .37	2 6 6 6	0-2' Brown medium sand and silt, some medium gravel
		2	SS REC .21	11 10 8 8	5-7' Same as above, slight gasoline odor
		3	SS REC .25	4 4 3 3	10-12' Dark gray medium sand, moist, some stone and gravel
		4	SS REC .12	2 2 2 2	15-17' Same as above with large cobbles, poor recovery.

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON
DESIGNERS CONSULTANTS

DRILLING LOG

WELL NUMBER: TB-24
OWNER: U.S. Air Force
LOCATION:
ADDRESS: Griffiss AFB, Rome, NY
TOTAL DEPTH: 17.0'
SURFACE ELEVATION:
WATER LEVEL: 11.2'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 6-26-84
DRILLER: J.
HELPER: G. Stevens
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	35 13 16 10	0-2' Gray fine to coarse sand, silt, some gravel. Cohesive
5		2	SS	7 11 9 10	5-7' Brown fine to medium sand, little silt, some gravel. Damp-loose
10		3	SS	7 5 3 3	10-12' Brown/Black fine to coarse sand, silt some gravel. Damp-loose. Strong fuel odor
15		4	SS	11 10 11 9	15-17' Same as above, wet. Moderate fuel odor.
17					

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-25　　OWNER: U.S. Air Force

LOCATION:　　ADDRESS: Griffiss AFB, Rome, NY

TOTAL DEPTH: 17.0'

SURFACE ELEVATION:　　WATER LEVEL:

DRILLING COMPANY: Empire　　DRILLING METHOD: Auger　　DATE DRILLED: 6-25-84

DRILLER:　　HELPER:

LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
		1	SS REC .75	4 8 6 6	0-2' Brown, fine sand and clay, gravel, damp and cohesive
		2	SS No Rec.	6 6 6 6	4-5' Brown medium sand, trace of silt, damp
		3	SS REC .25	4 6 6 6	7-9' Dark gray medium to coarse sand, little fine gravel
		4	SS REC .12	10 4 4 4	10-12' Brownish black fine to coarse sand, fine to coarse gravel, damp, strong odor
		5	SS REC .75	4 4 4 4	15-17' Brownish black fine to coarse sand some silt, fine gravel, wet, medium odor

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB - 26 OWNER: U.S. Air Force
LOCATION: Grassy area in front of Building 3, Griffiss Air Force Base ADDRESS: Griffiss AFB Rome NY
TOTAL DEPTH: 17.0'
SURFACE ELEVATION: WATER LEVEL: 12.2'
DRILLING COMPANY: Empire DRILLING METHOD: Auger DATE DRILLED: 6-25-84
DRILLER: J. HELPER: G. Stevens
LOG BY: D Jones

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
		1	SS REC .25	2 5 8 17	0-2' Topsoil over gravel up to 3" diameter.
		2	SS REC .33	7 7 6 6	5-7' Dark brown to reddish brown fine to coarse sand, some silt, gravel.
		3	SS REC .46	4 5 5 8	10-12' Gray sandy silt, moist, strong gasoline odor.
		4	SS REC .21	2 4 8 6	15-17' Same as above, faint gasoline odor.

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-27
OWNER: U.S. Air Force
LOCATION: Tank Farm Area
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH:
SURFACE ELEVATION:
WATER LEVEL:
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 6-26-84
DRILLER:
HELPER:
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
		1	SS	2 3 4 5	0-2' Brown topsoil, fine sandy silt, damp, cohesive some medium to coarse black railroad slag.
		2	SS	9 8 9 11	5-7' Brown fine to coarse sand, some fine to medium gravel, little silt, loose, damp
		3	SS	4 2 2 1	10-12' Brown silty, fine to coarse sand, wet loose
		4	SS	11 10 11 8	15-17' Grey fine to coarse sand and fine gravel, some silt. Saturated - firm

* A.S.T.M. D1586

SHEET ____ OF ____

WESTON

DRILLING LOG

WELL NUMBER: TB-28 OWNER: U.S. Air Force

LOCATION: Tank Farm Area ADDRESS: Griffiss AFB Rome, NY

TOTAL DEPTH 17.0'

SURFACE ELEVATION: WATER LEVEL: 11.0'

DRILLING COMPANY: Empire DRILLING METHOD: Auger DATE DRILLED: 6-27-84

DRILLER: HELPER:

LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	22, 3, 7, 7	0-2' Brown fine to coarse sandy silt, some gravel
5		2	SS	7, 4, 3, 2	5-7' Brown fine to coarse sandy silt, some fine to medium gravel Loose - damp.
10					
		3	SS	3, 5, 5, 11	12-14' Brown silty medium to coarse sand, some fine to medium gravel Strong fuel odor. Loose - wet
15		4	SS	4, 7, 5, 7	15-17' Same as above

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-29
OWNER: U.S. Air Force
LOCATION: Parking lot / road area beside building 3
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH 17.0"
SURFACE ELEVATION:
WATER LEVEL: 11.4'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 6-27-84
DRILLER:
HELPER:
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
		–	–	–	0-.25' Asphalt gravel bed
		–	–	–	.25-2' Brown medium sand, fine to medium gravel, silt, loose
		–	–	–	4-5' Brown sandy silt, coarse gravel, small cobbles.
5		1	SS	7 6 4 4	5-7' Dark brown fine to medium sandy silt, granular, very slight odor
10		2	SS	2 1 1 1	10-12' Dark brown to black medium to coarse sand, some fine sandy silt, loose, wet
15		3	SS	4 2 3 2	15-17' Brown medium to coarse sand, little fine sand and silt, loose, wet

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB - 30
OWNER: U.S. Air Force
LOCATION: Tank Farm Area
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH: 17.0'
SURFACE ELEVATION:
WATER LEVEL: 12.6'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 6-28-84
DRILLER:
HELPER:
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
		1	SS	37 17 16 20	0-2' Orangish brown silty fine to coarse sand, damp
		2	SS	10 10 6 5	5-7' Dark brown fine to medium sandy silt, some fine to medium gravel, slightly cohesive, damp
		3	SS	3 3 4 3	10-12' Dark brown silty fine to medium sand, granular, some coarse sand, little fine to medium gravel, loose, wet
		4	SS	1 3 2 2	15-17' Brown fine to coarse sand, trace of silt, some fine to coarse gravel, wet, loose

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-31
OWNER: U.S. Air Force
LOCATION: S. Corner of Building 3 on Moody St.
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH: 17.0'
SURFACE ELEVATION:
WATER LEVEL: 11.5'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-9-84
DRILLER: A. Boutoille
HELPER: G. Stevens
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0					0-.5' Concrete
5		1	SS	9 9 8 6	5-7' Brown fine to coarse sand and gravel, some silt. Damp and firm
10		2	SS	6 5 4 4	10-12' No recovery - same as above
15		3	SS	12 9 9 14	15-17' Same as above with trace of silt Saturated and firm

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-32
LOCATION:
SURFACE ELEVATION:
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-9-84
DRILLER: A. Boutcille
HELPER: G. Stevens
LOG BY: J. Williams

OWNER: U.S. Air Force
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH 17.0'
WATER LEVEL: 11.2'

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	2 5 9 5	0-2' Brown fine to coarse sand, gravel and silt, damp and firm
5		2	SS	3 5 6 5	5-7' Same as above, moist
10		3	SS	6 9 5 5	10-12' Same as above, wet
15		4	SS	5 2 1 1	15-17' Brown fine sand, some silt, trace fine gravel, saturated, loose

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-33
OWNER: U.S. Air Force
LOCATION: West of Bldg 3 on Moody
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH: 17.0'
SURFACE ELEVATION:
WATER LEVEL: 11.0'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-9-84
DRILLER: A. Boutoille
HELPER: G. Stevens
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	6 5 5 4	0-2' Brown coarse to fine sand and silt, some fine gravel, moist firm, slight fuel odor
5		2	SS	3 2 2 2	5-7' Same as above, loose
10		3	SS	7 5 4 2	10-12' Brown coarse to fine sand, little gravel and silt, damp, loose. slight petrol odor.
15		4	SS	3 2 2 2	15-17' Same as above, some fine gravel, wet loose

* A.S.T.M. D1586

SHEET ____ OF ____

WESTON

DRILLING LOG

WELL NUMBER: TB-34
OWNER: U.S. Air Force
LOCATION: Building 210
ADDRESS: Griffiss AFB, Rome, NY
TOTAL DEPTH: 22.0'
SURFACE ELEVATION:
WATER LEVEL: 18.0'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-3-84
DRILLER: A. Boutoille
HELPER: G. Stevens
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	3 12 10 19	0-2' Brown coarse to fine sand, silt and gravel. Damp and firm
5		2	SS	15 9 6 6	5-7' No recovery - coarse gravel blocked spoon.
10		3	SS	7 6 6 6	10-12' Brown coarse to fine sand and gravel, some silt. Damp and firm.
15		4	SS	5 3 7 12	15-17' Brown medium to fine sand little to trace silt with seams of gravel. Wet and firm.
20		5	SS	4 8 35 35	20-22' Same as above, compact
22					

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-35 OWNER: U.S. Air Force

LOCATION: Building 210 ADDRESS: Griffiss AFB Rome, NY

TOTAL DEPTH 22.0'

SURFACE ELEVATION: WATER LEVEL: 17.1'

DRILLING COMPANY: Empire DRILLING METHOD: Auger DATE DRILLED: 7-9-84

DRILLER: HELPER:

LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	5 4 4 11	0-2' Brown fine to coarse sand, little silt trace gravel. Damp-loose
5		2	SS	6 6 7 10	5-7' Brown fine to coarse sand, gravel and silt. Moist-firm
10		3	SS	8 14 11 12	10-12' Similar with some to little silt
15		4	SS	3 4 3 3	15-17' No recovery
20, 22		5	SS	3 3 2 2	20-22' Brown fine sand, some silt, trace of gravel. Saturated - loose.

* A.S.T.M. D1586

SHEET 1 OF 1

WESTON

DRILLING LOG

WELL NUMBER: TB-36
LOCATION: Building 210

SURFACE ELEVATION:

OWNER: U.S. Air Force
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH: 22.0'
WATER LEVEL: 17.5'

DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-4-84
DRILLER: J.
HELPER: G. Stevens

LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	4 13	0-2' Brown fine to coarse sandy silt, some
				24 16	fine to medium gravel, loose
5		2	SS	7 7	5-7' Same as above
				8 13	
10		3	SS	10 7	10-12' Brown fine to coarse sand, little silt,
				9 8	some fine gravel, wet
15		4	SS	4 2	15-17' Same as above
				4 3	
20		5	SS	3 3	20-22' Brown fine to coarse sand, little to
				6 9	trace silt, trace fine gravel, saturated

* A.S.T.M. D1586

SHEET ____ OF ____

WESTON

DRILLING LOG

WELL NUMBER: TB-37
OWNER: U.S. Air Force
LOCATION: Building 210
ADDRESS: Griffiss AFB, Rome, NY
TOTAL DEPTH: 22.0'
SURFACE ELEVATION:
WATER LEVEL: 18.2'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-4-84
DRILLER:
HELPER:
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	3 11 15 21	0-2' Brown sandy silt, some fine to coarse gravel. Damp - firm
5		2	SS	7 7 9 10	5-7' Same as above
10		3	SS	6 6 15 27	10-12' Brown fine to coarse sand, some fine silt and gravel. Moist - firm
15		4	SS	6 2 2 3	15-17' Brown sandy silt. Wet - loose
20		5	SS	4 2 2 1	20-22' Brown fine to coarse sand, some fine gravel and little silt. Saturated - loose.
22					

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-38
OWNER: U.S. Air Force
LOCATION: Building 210
ADDRESS: Griffiss AFB
Rome, NY
TOTAL DEPTH: 22.0'
SURFACE ELEVATION:
WATER LEVEL: 18.6'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-3-84
DRILLER:
HELPER:
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	2 10 14 21	0-2' Brown fine to coarse sand, gravel and silt. Damp - compact
5		2	SS	9 6 3 3	5-7' Same as above with some silt. Damp and loose
10		3	SS	10 6 4 3	10-12' Same as above. Damp firm
15		4	SS	6 5 3 3	15-17' Brown fine to coarse sand and fine gravel, little silt. Wet - loose
20		5	SS	2 4 7 8	20-22' Brown fine to coarse sand, little to trace silt, trace fine gravel. Saturated - firm.
30					

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-39
OWNER: U.S. Air Force
LOCATION: Bldg. 210
ADDRESS: Griffiss AFB Rome, NY
TOTAL DEPTH: 22.0'
SURFACE ELEVATION:
WATER LEVEL: 17.5'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-4-84
DRILLER:
HELPER: G. Stevens
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	4/4 21/20	0-2' Brown silty fine to coarse sand, some fine to coarse gravel, loose
5		2	SS	7/7 6/6	5-7' Dark brown fine to medium sandy silt, some fine to coarse gravel
10		3	SS	12/11 9/8	10-12' Brown fine to coarse sand and gravel wet, loose
15		-	SS	10/5 5/5	15-17' No recovery
20		6	SS	2/2 7/2	20-22' Brown fine to coarse sand, little silt, trace fine gravel, wet, loose
22					

* A.S.T.M. D1586

SHEET ___ OF ___

WESTON

DRILLING LOG

WELL NUMBER: TB-40
OWNER: U.S. Air Force
LOCATION: Building 210
ADDRESS: Griffiss AFB, Rome, NY
TOTAL DEPTH: 22.0'
SURFACE ELEVATION:
WATER LEVEL: 17.0'
DRILLING COMPANY: Empire
DRILLING METHOD: Auger
DATE DRILLED: 7-4-84
DRILLER:
HELPER:
LOG BY: J. Williams

SKETCH MAP

NOTES:

DEPTH (FEET)	GRAPHIC LOG	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS*	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		1	SS	5 20	0-2' Poor recovery - coarse gravel in spoon
				20 16	
5		2	SS	10 12	5-7' Brown fine to coarse sand and gravel
				12 9	Damp - firm
10		3	SS	11 8	10-12' Same as above
				10 7	
15		4	SS	6 7	15-17' Same as above
				4 2	
20		5	SS	8 6	20-22' Brown fine to coarse sand and fine
22				7 6	gravel, trace silt

* A.S.T.M. D1586

SHEET 1 OF 1

Appendix E

Water and Soil QA/QC

SAMPLE NUMBERING SYSTEM

The Monitor Well numbering system was changed in the report text to conform to existing IRP monitor well numbering system. This laboratory report uses the original system used in field notes and laboratory documentation.

Transposition is as follows:

Field and Laboratory	Report Text
MW-BA	Blank
MW-1	MW-15
MW-2	MW-16
MW-2A	MW-16 (dup)
MW-3	MW-17
MW-4	MW-18
FF-EX	MW-19
MW-39	MW-20
MW-B1	MW-21
MW-A1	MW-22
MW-33	MW-23
MW-29	MW-24
MW-F1	MW-25
MW-17	MW-26
MW-L1	MW-27
MW-19	MW-28
MW-EX	MW-CE

DATE OF REPORT: MAY 8, 1985

GRIFFIS A.F.B.
REVISED REPORT
FOR
SOIL SAMPLES COLLECTED JULY 5, 1984
W.O. NO. 0628-05-41
TOTAL METALS SUMMARY REPORT

DATE SAMPLES RECEIVED: JULY 9, 1984
DATE ANALYSIS COMPLETE: SEPTEMBER 10, 1984

R.F.W. NO.	SAMPLE DESCRIPTION	Sb mg/kg	Cr mg/kg	Cu mg/kg	Fe mg/kg	Pb mg/kg	Mn mg/kg	Zn mg/kg
8408-428-0010	1-1	19	10	45	6,700	17	215	20
-0010 DUP	1-1 DUPLICATE	15	6	24	6,350	48	232	31
-0020	101-1	193	34	784	6,430	83,000	27	262
-0030	101-2	11	4	30	498	1,170	5	9
-0040	101-3	11	12	62	26,000	465	33	29
-0050	101-4	7	3	42	4,300	53	161	72
-0060	222-1	25	6	500	302	65,800	3	329
-0070	222-2	5	<3	16	366	861	4	85
-0080	222-3	6	3	171	322	784	<1	128
-0090	222-4	6	<3	9	324	638	<1	29
-0100	222-5	4	<3	5	38	364	<1	14
-0110	222-6	5	<3	11	107	107	<1	20
DETECTION LIMITS:		10	3	2	3	25	1	1

NOTE: There are no EPA recommended holding times for soil sample analysis and no specific detection limits were requested on the Task order.

WESTON

DATE: MAY 8, 1985

GRIFFISS A.F.B.
REVISED REPORT
FOR
WATER SAMPLES COLLECTED
AUGUST 15-17, 1984
W.O. NO. 0628-05-41

I. OIL AND GREASE ANALYSIS

a)

R.F.W. NO.	SAMPLE DESCRIPTION	DATE COLLECTED	DATE ANALYZED	OIL&GREASE, mg/L
8408-575-0010	MW-BA LANDFILL 7	8-15-84	9-6-84	<0.1
-0020	MW-1	8-15-84	9-6-84	0.15
-0030	MW-2	8-15-84	9-6-84	0.13
-0040	MW-2A	8-15-84	9-6-84	0.16
-0050	MW-3	8-15-84	9-6-84	0.46
-0060	MW-4	8-15-84	9-6-84	0.25
-0070	LF-EX	8-17-84	9-6-84	0.66
-0080	SEEP	8-17-84	9-6-84	0.70
-0090	MW-A1	8-16-84	9-6-84	7.32
-0100	MW-B1	8-16-84	9-6-84	12.4
-0110	MW-B2A	8-17-84	9-6-84	<0.1
-0120	MW-F1	8-16-84	9-6-84	0.42
-0130	MW-F1A	8-16-84	9-6-84	0.19
-0140	MW-L1	8-17-84	9-6-84	0.55
-0150	MW-17	8-17-84	9-6-84	20.6
-0160	MW-19	8-16-84	9-6-84	<0.1
-0170	MW-29	8-16-84	9-6-84	0.28
-0180	MW-33	8-16-84	9-6-84	1.17
-0190	MW-34	8-17-84	9-6-84	0.17
-0200	MW-39	8-17-84	9-6-84	0.20
-0210	MW-39A	8-17-84	9-6-84	0.32
-0220	MW-EX	NO DATE RECORDED	9-6-84	1.30

WESTON

DATE: MAY 8, 1985

GRIFFISS A.F.B. (CON'T.) PG. 3

I. OIL & GREASE ANALYSIS (CON'T.)

b) These samples were analyzed using EPA METHOD 413.2 within the EPA recommended holding time of 28 days. The requested detection limit of 0.10 mg/L was achieved.

II. TOTAL PHENOLICS ANALYSIS

a)

R.F.W. NO.	SAMPLE DESCRIPTION	DATE COLLECTED	DATE ANALYZED	TOTAL PHENOLICS, mg/L
8408-575-0010	MW-BA LANDFILL 7	8-15-84	by 9-12-84	< 0.005
-0020	MW-1	8-15-84	by 9-12-84	< 0.005
-0030	MW-2	8-15-84	by 9-12-84	0.008
-0040	MW-2A	8-15-84	by 9-12-84	< 0.005
-0050	MW-3	8-15-84	by 9-12-84	< 0.005
-0060	MW-4	8-15-84	by 9-12-84	< 0.005
-0070	LF-EX	8-17-84	by 9-12-84	0.019
-0080	SEEP	8-17-74	by 9-12-84	< 0.005
8408-575-0030 DUP	MW-2 DUPLICATE	8-15-84	by 9-12-84	0.017
-0030 SPIKE	MW-2 SPIKE	8-15-84	by 9-12-84	87% RECOVERY
8408-575-0060 DUP	MW-4 DUPLICATE	8-15-84	by 9-12-84	< 0.005
-0060 SPIKE	MW-4 SPIKE	8-15-84	by 9-12-84	108% RECOVERY

b) These samples were analyzed using EPA METHOD 420.1 within the EPA recommended holding time of 28 days. Although the requested detection limit was 1 μg/L (0.001 mg/L), there is currently no method capable of acheiving this level. EPA Method 420.1 is sensitive to 5 μg/L.

III. TOTAL ORGANIC CARBON (TOC) ANALYSIS

a)

R.F.W. NO:	SAMPLE DESCRIPTION	DATE COLLECTED	DATE ANALYZED	TOC mg/L
8408-575-0010	MW-BA Landfill	8/15/84	9/6/84	<9.0
-0020	MW-1	8/15/84	9/6/84	11.0
-0030	MW-2	8/15/84	9/6/84	77.8
-0040	MW-2A	8/15/84	9/6/84	89.5
-0050	MW-3	8/15/84	9/6/84	49.3
-0060	MW-4	8/15/84	9/6/84	15.5
-0070	LF-EX	8/17/84	9/6/84	71.4
-0080	Seep	8/17/84	9/6/84	16.9
-0080 Dup.	Seep Duplicate	8/17/84	9/6/84	17.4
-0080 (Spike)	Seep Spike	8/17/84	9/6/84	78% Recovery
-0090	MW-A1	8/16/84	9/7/84	10.6
-0100	MW-B1	8/16/84	9/7/84	84.8
-0110	MW-B2A	8/17/84	9/7/84	<2.0
-0120	MW-F1	8/16/84	9/7/84	<2.0
-0130	MW-F1A	8/16/84	9/7/84	<2.0
-0140	MW-L1	8/17/84	9/7/84	<2.0
-0150	MW-17	8/17/84	9/7/84	<2.0
-0160	MW-19	8/16/84	9/7/84	<2.0
-0170	MW-29	8/16/84	9/7/84	23.2
-0180	MW-33	8/16/84	9/7/84	32.7
-0190	MW-34	8/17/84	9/7/84	43.0
-0200	MW-39	8/17/84	9/7/84	28.5

WESTON DATE: MAY 8, 1985

GRIFFISS A.F.B. (CON'T). PG.5

III. TOTAL ORGANIC CARBON (TOC) ANALYSIS (CON'T.)

R.F.W. NO.	SAMPLE DESCRIPTION	DATE COLLECTED	DATE ANALYZED	TOC, mg/L
8408-575-0210	MW-39A	8-17-84	9-7-84	20.7
-0220	MW-EX	NO DATE RECORDED	9-7-84	19.7
8408-575/	LAB BLANK	-------	9-7-84	<2.0
-0090 DUP	MW-A1 DUP.	8-16-84	9-7-84	10.3
-0090 SPIKE	MW-A1 SPIKE	8-16-84	9-7-84	94% RECOVERY

b) Although the requested detection limit for TOC was 1 mg/L, the laboratory did not have an instrument capable of achieving this detection limit until after these samples would have exceeded their holding times. Samples 8408-575-0010 were analyzed using a Dohrmann instrument capable of achieving a detection limit of 9 mg/L. Samples 8408-575-0090 to 0220 were analyzed on an "Ionics" instrument capable of achieving a detection limit of 2.0 mg/L. These samples were analyzed within the EPA recommended holding time of 28 days.

IV. SOLUBLE METALS ANALYSIS

a)

R.F.W. NO.	SAMPLE DESCRIPTION	DATE COLLECTED	DATE ANALYZED	SOLUBLE As µg/L	Cd µg/L	Cr µg/L	Cu µg/L	Hg µg/L	Pb µg/L	Ni µg/L	Ag µg/L
8408-575-0010	MW-BA (LANDFILL 7)	8-15-84	9-8-84	<10	<10	<0.05	<0.03	<0.5	<10	<0.1	<10
-0020	MW-1	8-15-84	9-8-84	<10	<10	<0.05	<0.03	<0.5	<10	<0.1	<10
-0030	MW-2	8-15-84	9-8-84	<10	<10	<0.05	0.05	<0.5	21	<0.1	<10
-0040	MW-2A	8-15-84	9-8-84	<10	<10	<0.05	0.09	<0.5	25	<0.1	<10
-0050	MW-3	8-15-84	9-8-84	<10	<10	<0.05	0.06	<0.5	<10	<0.1	<10
-0060	MW-4	8-15-84	9-8-84	<10	<10	<0.05	0.08	<0.5	<10	<0.1	<10
-0070	LF-EX	8-17-84	9-8-84	<10	<10	<0.05	0.05	<0.5	<10	<0.1	<10
-0080	SEEP	8-17-84	9-8-84	<10	<10	<0.05	<0.03	<0.5	<10	<0.1	<10

b) These samples were analyzed within the EPA recommended holding time of 6 months. As, Cd, Pb and Ag results were determined using an AA furnace, Hg by AA cold vapor, and Cr, Cu, and Ni by ICP. The requested detection limits were achieved except for Copper and are indicated by "less than" signs. (See memo of January 31, 1985).

V. SOLUBLE LEAD (Pb) ANALYSIS

a)

R.F.W. NO.	SAMPLE DESCRIPTION	DATE COLLECTED	DATE ANALYZED	SOL. Pb, µg/L
8408-575-0090	MW-A1	8-16-84	9-8-84	<10
-0100	MW-B1	8-16-84	9-8-84	23
-0110	MW-B2A	8-17-84	9-8-84	<10
-0120	MW-F1	8-16-84	9-8-84	<10
-0130	MW-F1A	8-16-84	9-8-84	<10
-0140	MW-L1	8-17-84	9-8-84	<10
-0150	MW-17	8-17-84	9-8-84	<10
-0160	MW-19	8-16-84	9-8-84	<10
-0170	MW-29	8-16-84	9-8-84	<10
-0180	MW-33	8-16-84	9-8-84	<10
-0190	MW-34	8-17-84	9-8-84	<10
-0200	MW-39	8-17-84	9-8-84	<10
-0210	MW-39A	8-17-84	9-8-84	<10
-0220	MW-EX	NO DATE RECORDED	9-8-84	<10

b) These samples were analyzed by AA within the EPA recommended holding time of six months and the requested detection limit of 20µg/L was met.

WESTON

Date: May 8, 1985

GRIFFISS A.F.B.

VOA REVISED REPORT

FOR

SAMPLES REC'D OCTOBER 11, 1984

W.O. NO. 0628-05-41

A. Samples 8410-726-0010 to 0080 were collected on October 9, 1984 and analyzed on October 23, 1984. The EPA recommended holding time of 14 days was not exceeded. Detection limits are indicated by "less than signs".

B. Results are attached.

C. Numbering System conforms to text.

GRIFFISS AIR FORCE BASE

R.F.W. SAMPLE NO.	8410-726.0010	726.0020	726.0030	726.0040	726.0050	726.0060	726.0070	726.0080	UNIT
CLIENT I.D.	MW-15	MW-16	MW-17	MW-18	SEEP	BLANK	MW-3	MW-15DUP	
CHLOROFORM	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	ng/mL
DICHLOROBROMOMETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	ng/mL
DIBROMOCHLOROMETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	ng/mL
BROMOFORM	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	ng/mL
1,1-DICHLOROETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	ng/mL
1,2-DICHLOROETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	ng/mL
1,1,1-TRICHLOROETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	ng/mL
1,1,2-TRICHLOROETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	ng/mL
2-CHLOROETHYLVINYL ETHER	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ng/mL
TETRACHLOROETHYLENE	3.9	2.8	105	1.0	1.0	1.0	1.6	1.5	ng/mL
CHLOROBENZENE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	ng/mL
1,1-DICHLOROETHYLENE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	ng/mL
CARBON TETRACHLORIDE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	ng/mL
1,2-DICHLOROPROPANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	ng/mL
TRICHLOROETHYLENE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	ng/mL
1,1,2,2-TETRACHLOROETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	ng/mL
TRANS-1,3-DICHLOROPROPANE	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	ng/mL
CIS-1,3-DICHLOROPROPANE	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	ng/mL
TRANS-1,2-DICHLOROETHYLENE	<1.0	<1.0	2.0	<1.0	<1.0	<1.0	<1.0	<1.0	ng/mL

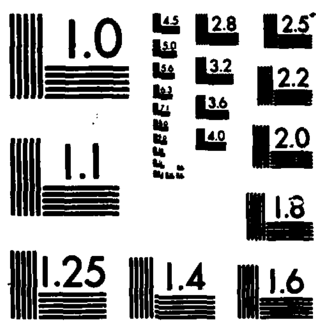
AD-A164 416 INSTALLATION RESTORATION PROGRAM PHASE II CONFIRMATION/QUANTIFICATION STA..(U) WESTON (ROY F) INC WEST CHESTER PA R JOHNSON ET AL. 20 FEB 85 3/3

UNCLASSIFIED F33615-80-D-4006 F/G 13/2 NL

END

FILMED

DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

GRIFFIS AIR FORCE BASE
EPA METHOD 602 RESULTS

RFW Sample No.	8410 726-0010	726-0020	726-0030	726-0040	726-0050	726-0060	726-0070	726-0080	Units ng/mL or ppb
Client I.D.	MW-15	MW-16	MW-17	MW-18	SEEP	Blank	MW-3**	MW-15Dup	
Benzene	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	*	ng/mL
Toluene	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	*	ng/mL
Ethyl Benzene	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	*	ng/mL
Xylene	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	*	ng/mL

*No results available for this sample. Sample vial was broken in the refrigerator

**RFW #726-0070 laboratory duplicate:

Benzene	< 2.0
Toluene	< 2.0
Ethyl Benzene	< 5.0
Xylene	< 2.0

Detection Limits: Benzene, Toluene, Xylene = 2.0 ng/mL
Ethyl Benzene = 5.0 ng/mL

QUALITY CONTROL DATA

GRIFFISS A.F.B.
WATERS a/

CLIENT: GRIFFISS A.F.B. APRIL 4, 1985

EPA METHOD 601 REPORT AND 602 REPORT

8410-

R.F.W. SAMPLE NO.	726.0010	726.0070	726.0080	UNIT						
CLIENT I.D.	MW-15	MW-3	MW-15DUP							
CHLOROFORM	<1.0	<1.0	<1.0	µg/L						
DICHLOROBROMOMETHANE	<1.0	<1.0	<1.0	"						
DIBROMOCHLOROMETHANE	<1.0	<1.0	<1.0	"						
BROMOFORM	<5.0	<5.0	<5.0	"						
1,1-DICHLOROETHANE	<1.0	<1.0	<1.0	"						
1,2-DICHLOROETHANE	<1.0	<1.0	<1.0	"						
1,1,1-TRICHLOROETHANE	<1.0	<1.0	<1.0	"						
1,1,2-TRICHLOROETHANE	<1.0	<1.0	<1.0	"						
2-CHLOROETHYLVINYL ETHER	<2.0	<2.0	<2.0	"						
TETRACHLOROETHYLENE	3.9	1.6	1.5	"						
CHLOROBENZENE	<1.0	<1.0	<1.0	"						
1,1-DICHLOROETHYLENE	<1.0	<1.0	<1.0	"						
CARBON TETRACHLORIDE	<1.0	<1.0	<1.0	"						
1,2-DICHLOROPROPANE	<1.0	<1.0	<1.0	"						
TRICHLOROETHYLENE	<1.0	<1.0	<1.0	"						
1,1,2,2-TETRACHLOROETHANE	<1.0	<1.0	<1.0	"						
TRANS-1,3-DICHLOROPROPANE	<5.0	<5.0	<5.0	"						
CIS-1,3-DICHLOROPROPANE	<5.0	<5.0	<5.0	"						
TRANS-1,2-DICHLOROETHYLENE	<1.0	<1.0	<1.0	"						
BENZENE	<2.0	<2.0,<2.0	--							
TOLUENE	<2.0	<2.0,<2.0	--							
ETHYL BENZENE	<5.0	<5.0,<5.0	--							
XYLENE	<2.0	<2.0,<2.0	--							

Approved By:
Earl M. Hansen, Ph.D.
Manager
WESTON Analytical Laboratories

a/ BLANK SPIKE DATA;

ANALYTE	BLANK VALUE (µg/L)	ADDED (µg/L)	RESULT (µg/L)	%RECOVERY
1,1,1-TRICHLOROETHANE	<1.0	9.5	7.4	78
TRICHLOROETHYLENE	<1.0	10	8	80
1,1,2,2-TETRACHLOROETHANE	<1.0	8	7.1	89

Appendix F

Pump and Recovery Test Results

Griffiss Air Force Base - Pump Test Results

Observation Well: MW-15

Test Start: 0900 HRS;8-15-84

Test End: 0902 HRS;8-15-84

Pumping Well: MW-15

Static Water Level (FT): 9.13

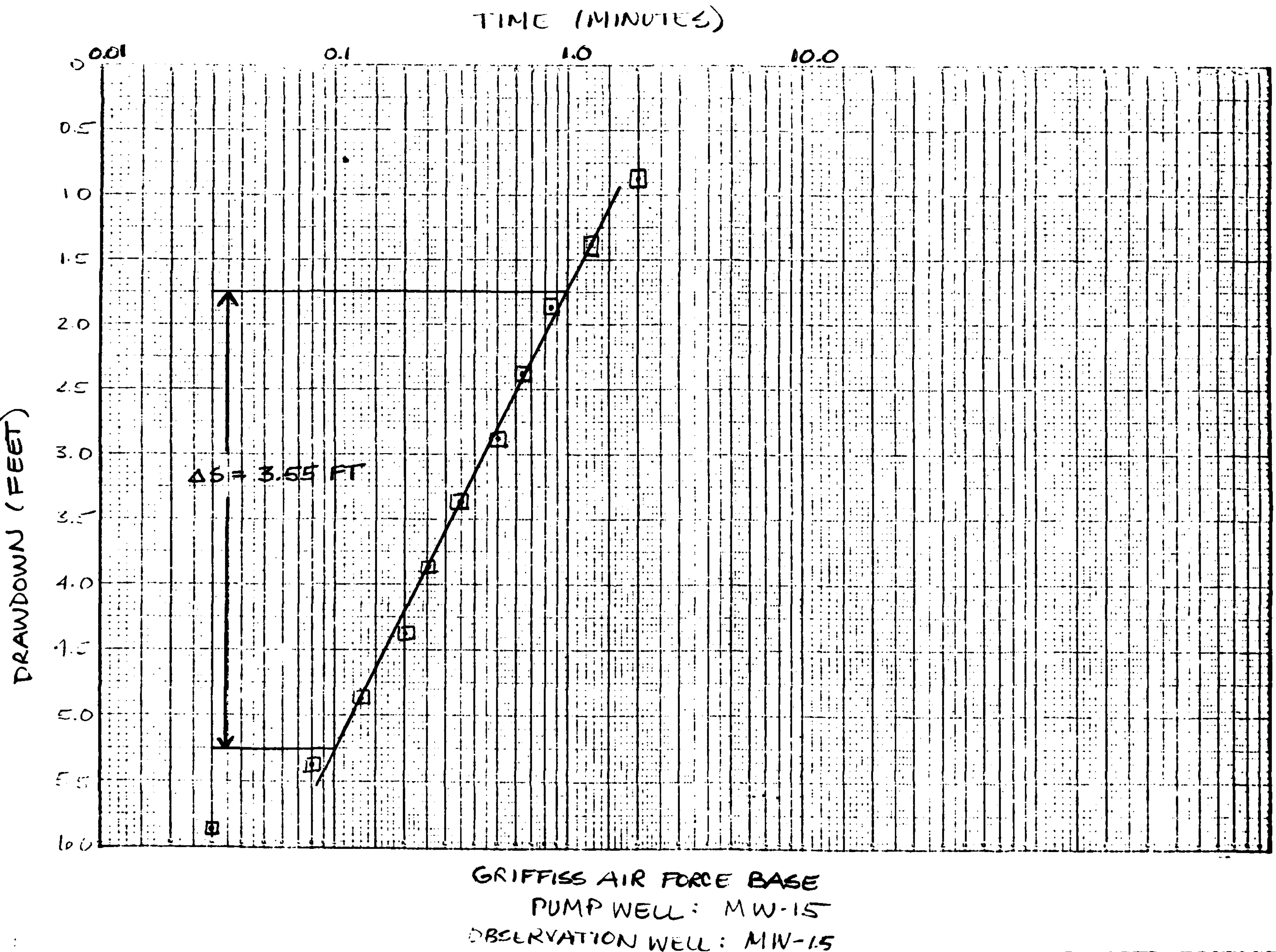
Duration of Pumping: 66 minutes

Pumping Rate(GPM) : 5

Time/Date:0858 HRS; 8-15-84

TIME	ELAPSED TIME (MIN.)	DTW (FT)	S (FT)
9:00	0.03	15.0	5.87
9:00	0.08	14.5	5.37
9:00	0.13	14.0	4.87
9:00	0.2	13.5	4.37
9:00	0.25	13.0	3.87
9:00	0.35	12.5	3.37
9:00	0.50	12.0	2.87
9:00	0.63	11.5	2.37
9:00	0.83	11.0	1.87
9:01	1.25	10.5	1.37
9:02	2.00	10.0	0.87

Transmissivity = 371.8 GAL/Day/ Ft.



TIME (MINUTES)
0.01
0.1
1.0
10.0
DRAWDOWN (FEET)
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
ΔS = 3.55 FT
GRIFFISS AIR FORCE BASE
PUMP WELL: MW-15
OBSERVATION WELL: MW-15

Griffiss Air Force Base - Pump Test Results

Observation Well: MW-18

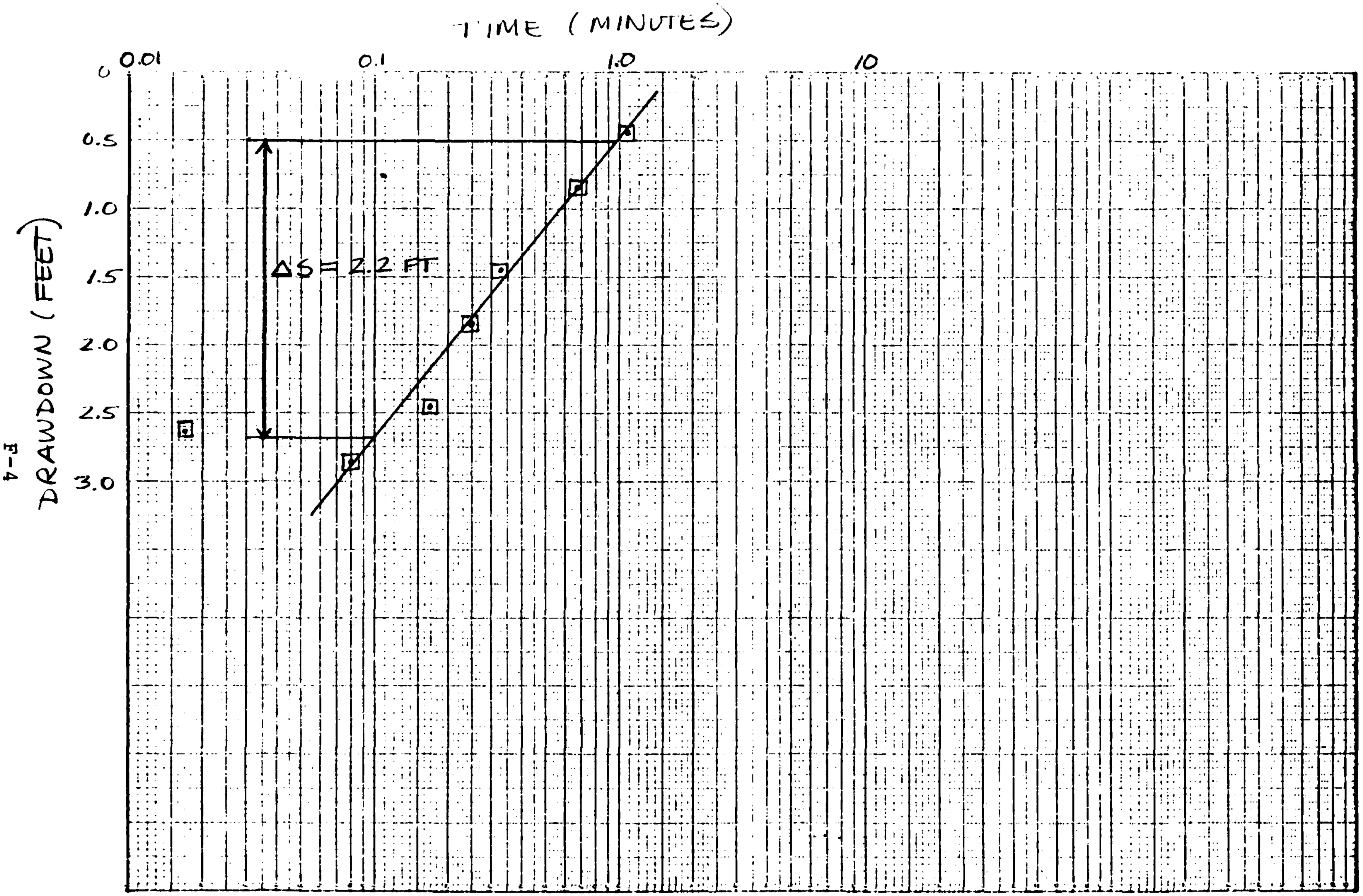
Test Start: 0855 HRS.; 8-15-84
Test End 0900 HRS.; 8-15-84

Pumping Well: MW-18
Static Water Level (FT) : 14.15

Duration of Pumping: 87 minutes
Pumping Rate (GPM) : 5
Time/Date: 0854 HRS ; 8-15-84

TIME	ELAPSED TIME (Min.)	DTW (FT)	S (FT)
8:55	0.017	16.79	2.64
8:55	0.08	17.00	2.85
8:55	0.17	16.60	2.45
8:55	0.25	16.00	1.85
8.55	0.33	15.60	1.45
8:56	0.67	15.00	0.85
8:56	1.08	14.60	0.45

Transmissivity = 600.0 GAL/Day/FT



GRIFFISS AIR FORCE BASE
PUMPING WELL : MW-18
OBSERVATION WELL : MW-18

Griffiss Air Force Base - Pump Test Results

Observation Well: MW-23

Test Start: 1200 HRS; 8-16-84

Test End: 1202 HRS; 8-16-84

Pumping Well: MW-23

Static Water Level (FT) : 10.65

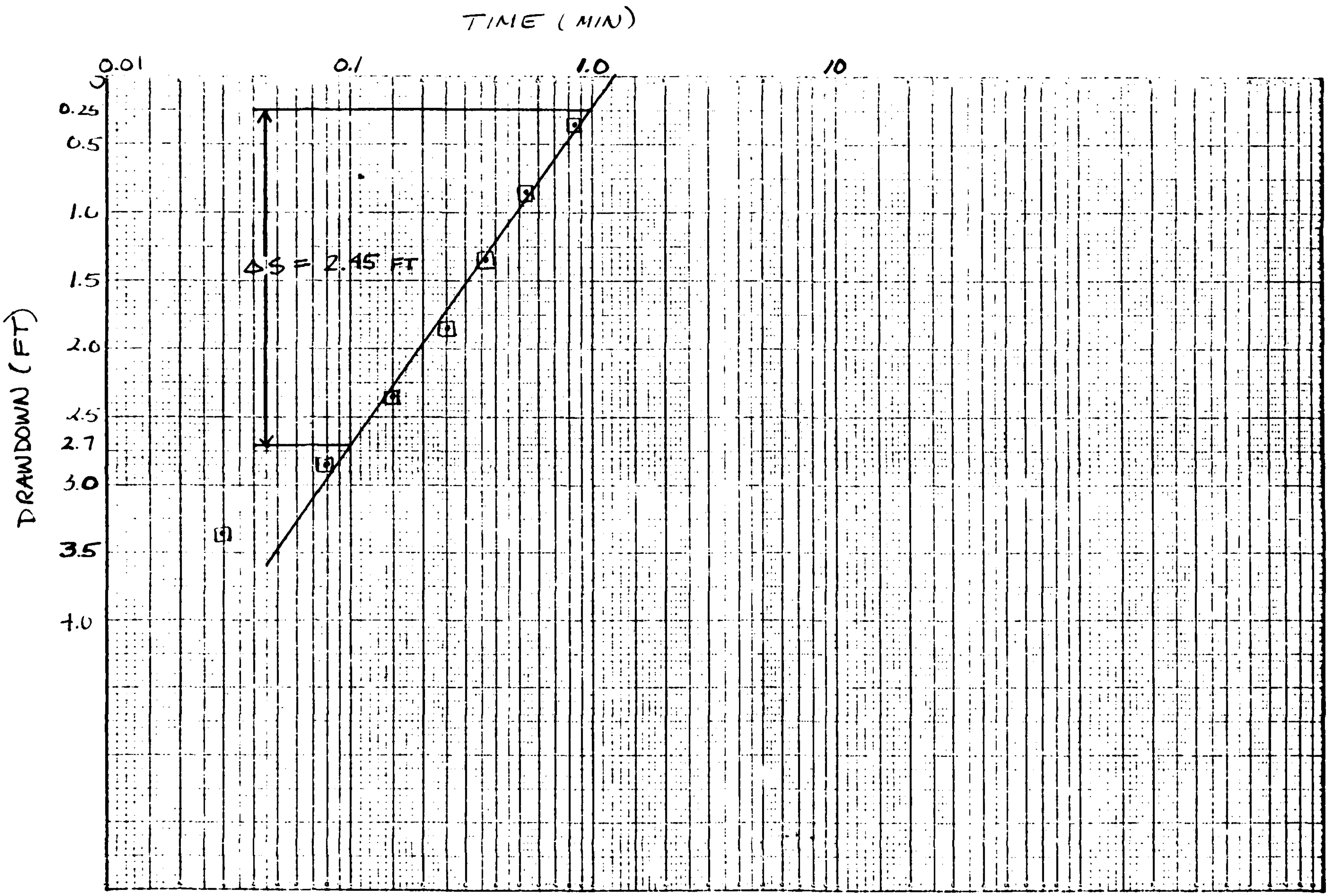
Duration of Pumping: 30 minutes

Pumping Rate (GPM) : 5

Time/Date: 1155 HRS; 8-16-84

TIME	ELAPSED TIME (MIN)	DTW (FT)	S (FT)
12:00	0.03	14.0	3.35
12:00	0.08	13.5	2.85
12:00	0.15	13.0	2.35
12:00	0.25	12.5	1.85
12:00	0.37	12.0	1.35
12:00	0.53	11.5	0.85
12:00	0.85	11.0	0.35

TRANSMISSIVITY = 538.8 GAL/Day/FT



GRIFFISS AIR FORCE BASE
PUMPING WELL : MW-23
OBSERVATION WELL : MW-23

Griffiss Air Force Base: Pump Test Results

Observation Well : MW-24

Test Start: 1100 HRS; 8-16-84

Test End: 1102 HRS ; 8-16-84

Pumping Well: MW-14

Static Water Level (FT) : 10.97

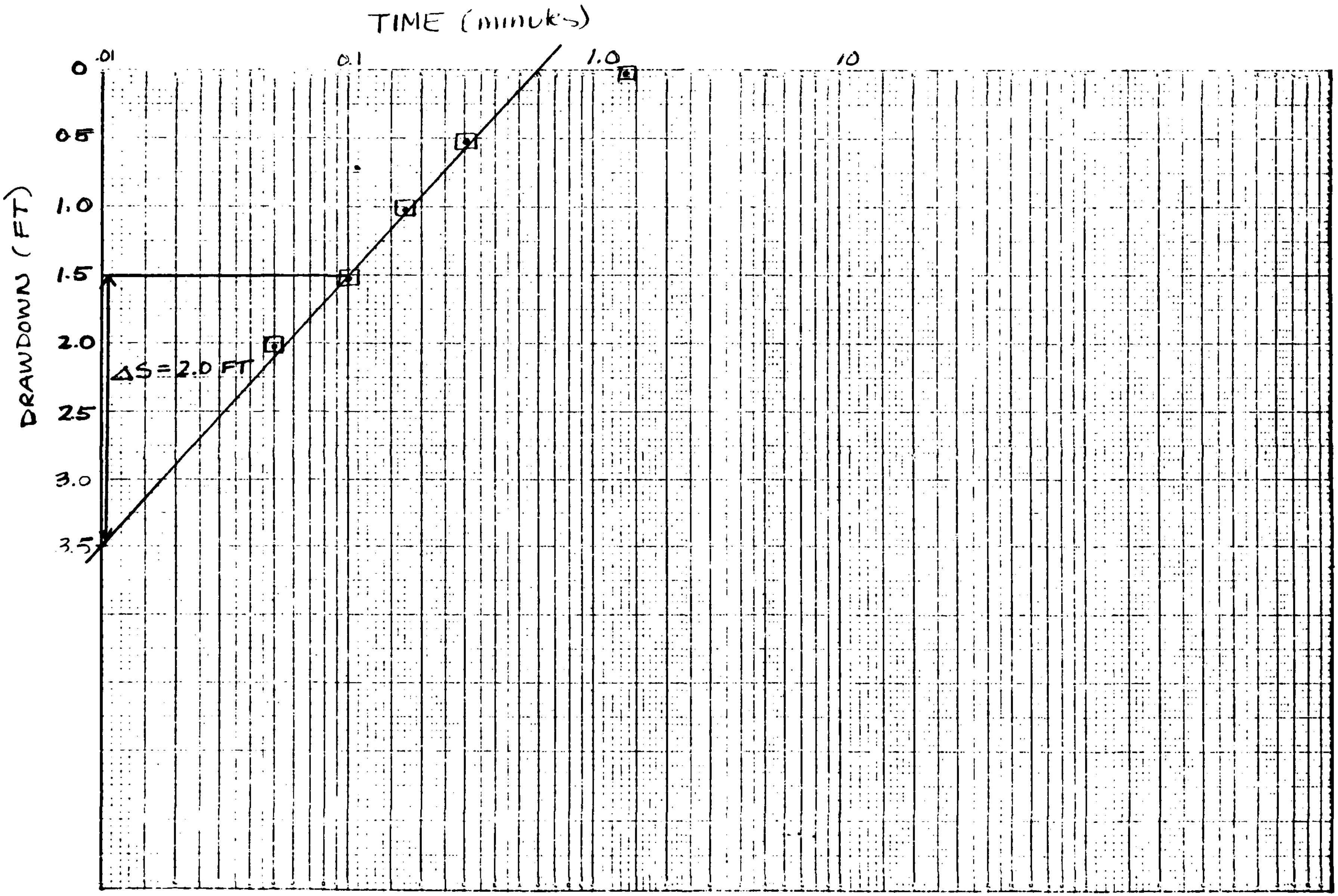
Duration of Pumping: 31 minutes

Pumping Rate (GPM): 5

Time/Date: 1055 HRS: 8-16-84

TIME	ELAPSED TIME (MIN)	DTW (FT)	S (FT)
11:00	0.05	13.0	2.03
11:00	0.10	12.5	1.53
11:00	0.17	12.0	1.03
11:00	0.30	11.5	0.53
11:01	1.33	11.0	0.03

Transmissivity = 660 GAL/Day/FT



GRIFFISS AIR FORCE BASE
PUMP WELL : MW-24
OBSERVATION WELL : MW-24

WELL TEST CALCULATIONS

$T = \frac{264Q}{S}$ where Q = pumping rate in gpm

$K = \frac{T}{H}$ S = residual drawdown over one log cycle

H = aquifer thickness

T = transmissivity in gal/day/ft

264 = conversion factor

K = hydraulic conductivity

MW-15 $T = \frac{264 \times 5}{3.55} = 371.8$ gal/ft/day

$K = \frac{371.8 \text{ gal/ft/day}}{10.97 \text{ ft}} \times \frac{\text{ft}^3}{7.48 \text{ gal}} = 4.53$ ft/day

MW-18 $T = \frac{264 \times 5}{2.2} = 600$ gal/ ft/day

$K = \frac{600 \text{ gal/ft/day}}{11.52 \text{ ft.}} \times \frac{\text{ft}^3}{7.48 \text{ gal}} = 6.96$ ft/day

MW-23 $T = \frac{264 \times 5}{2.0} = 538.7$ gal/ft/day

$K = \frac{538.7 \text{ gal/ft/day}}{12.85 \text{ ft}} \times \frac{\text{ft}^3}{7.48 \text{ gal}} = 5.60$ ft/day

MW-24 $T = \frac{264 \times 5}{2.0} = 660$ gal/ft/day

$K = \frac{600 \text{ gal/ft/day}}{12.43} \times \frac{\text{ft}^3}{7.48 \text{ gal}} = 7.10$ ft/day

APPENDIX G

Sampling and Quality Assurance Plans

APPENDIX G

SAMPLING AND QA/QC PLANS

G-1.1 MONITORING WELL PURGING

All groundwater sampling was accomplished after the installed monitoring wells were properly developed and had stabilized for a period of at least two weeks. Prior to collecting samples, each well was purged by pumping a minimum of three volumes of standing water in the well using a Johnson-Keck submersible pump[1]. This ensured that a representative sample of the aquifer is collected during the sampling process. The field procedures used for monitoring well purging included the following guidelines:

1. Prior to placing any equipment into the well, the equipment was scrubbed with Alconox (detergent) solution and rinsed with distilled water.

2. Before purging, the depth to water from the referenced measuring point on the top of the well casing was measured and recorded.

3. The volume of water to be purged based on the amount of standing water in the well casing was calculated.

4. The well was purged by pumping, removing at least three times the calculated volume of standing water in the well casing.

5. The pump was disconnected and removed from the well. The equipment was decontaminated by scrubbing with Alconox and flushed with deionized water.

6. The protective caps were secured.

G-1.2 MONITOR WELL SAMPLE COLLECTION

Groundwater sampling was directed toward the detection of:

1. Phenols
2. Volatile Organic Compounds (VOC)

---

[1] A 1.5-inch diameter stainless steel, screw-lift type pump. Capable of a steady flow of around one gpm. A Teflon discharge hose was used.

G-1.3 SOIL SAMPLING

All soil sampling accomplished using a drill rig employed the Standard Penetration Test (ASTM Method 1586) using a steel split-spoon sampler. Prior to taking each sample, the following procedures were followed:

1. The split-spoon sampler was washed thoroughly with an Alconox and water solution, and rinsed in tap water from the Base-approved source for drilling.

2. After assembly of the sampler, the sampler was lowered into the boring and the sample taken by the Standard Penetration Test Method.

3. Upon recovery of the sampler the spoon was split and the sample examined for soil characteristics.

4. The sample was then cleaned of any smeared sample around the outside of the sampler, and the cleaned, representative sample was put in a marked and labelled 1 liter clear glass sampling jar with a screw cap.

   Soil samples at Griffiss AFB were taken for analysis of the following heavy metals: chromium, iron, lead, copper, manganese, zinc, and antimony.

G-2.0 QUALITY ASSURANCE PLAN

WESTON Analytical Services enforces a rigid QA/QC program toward maintenance of validity and reliability of all analytical data. The Laboratory QA/QC Manual

outlines the specifics of the QA/QC plan. This plan is patterned after the EPA Handbook for Analytical Quality Control in Water and Wastewater Laboratories (EPA-600/4-79-019, March 1979), augmented by general applicable experience and interaction with the QA/QC plan of the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA). All methods and procedures followed by WESTOn are either USEPA or ASTM-approved. Any variations from such procedures, regardless of cause, are documented by the responsible analyst(s) and are documentable, and, literature-traceable. A general review of this QA/QC plan is in the following paragraphs.

Although specific QA/QC measures for each method are designated in WESTON's Laboratory Quality Assurance Manual, the general QA/QC program normally includes:

- o EPA-acceptable sample preparation and analytical methods.
- o Instrument calibration via use of Standard Analytical Reference Materials (SARMS).
- o Regular equipment maintenance and servicing.

- Use of SARMS and QA/QC samples (spikes, laboratory blanks, replicates, and splits) to ascertain overall precision.
- Statistical evaluation of data to delineate acceptable limits.
- Documentation of system/operator performance.
- Suitable chain-of-custody procedures.
- Maintenance and archiving of all records, charts, and logs generated in the above.
- Proper reporting.

Acceptable analyses at WESTON's Analytical Laboratory Services include, but are not limited to, the above.

In general, WESTON's QA/QC sequence follows the following diagram (Figure G-1). Documentation (as available from instrument recordings and technicians' notebooks) is sufficient to validate each step in the sequence.

G.2.2 CONTAINER PREPARATION

Another consideration in this, or any, analytical project is that of sample container preparation. Accordingly, all appropriate sample bottles shall be cleaned in a manner mandated by the U.S. EPA to insure maximal cleanliness (and minimal contamination) before the containers go to the field. Sufficient bottles to accommodate both laboratory and field blank requirements will be preferred in a single batch mode for each monthly sampling requirement.

G.2.3 VERIFICATION/VALIDATION

In the laboratory, the analytical scheme begins with initial verification, which is comprised of:

- Lab Blanks - To insure that no background level of specific analytes is introduced by laboratory procedures.
- Standard Analytical Reference Materials (SARMS) - To determine the accuracy and precision of procedures.

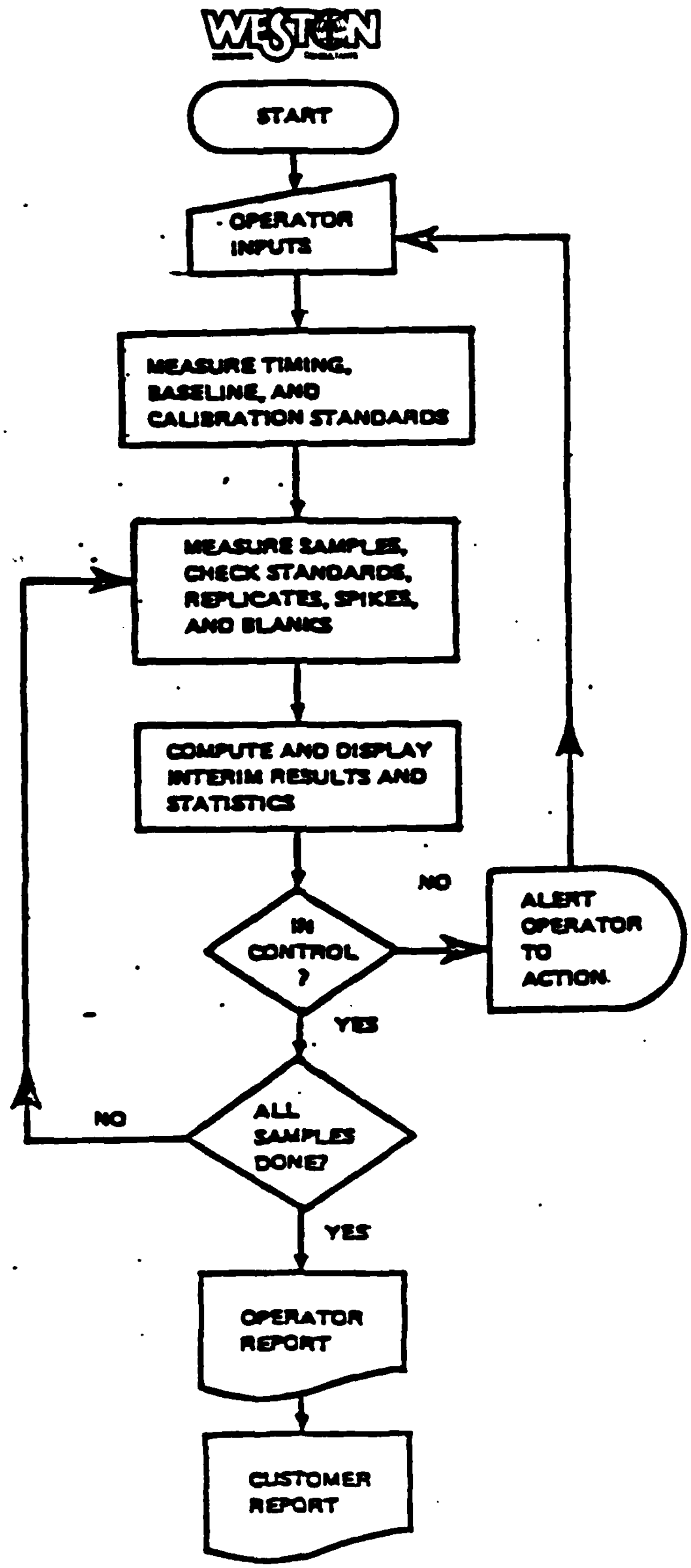


Figure G-1 : Flow Chart of the Sequence of Events during a Controlled Series of Laboratory Measurements.

- Spikes - To determine the percent recovery of analyte(s).

If the laboratory QA/QC program is extended to the field, it includes a fifth item:

- Field Blanks - To provide a check on contamination of containers and/or preservatives and to establish "practical" detection limits.

WESTON has used all of the above in this project. All data resulting from these verification media have been archived for future reference, retrieval, or processing.

G.2.4 DATA HANDLING - LABORATORY

Use of any analytical data should be preceded by an assessment of its quality. The assessment should be based on accuracy, precision, completeness, representativeness, and comparability. These criteria are, in turn, assessed as follows:

- Accuracy - Is it acceptable for the planned use? QA/QC shall measure the accuracy of all data.

- Precision - Is it acceptable for the planned use? QA/QC shall reflect the reproducibility of the measurements.

- Completeness - Are the data sufficient for the planned use? QA/QC shall identify the quantity of data needed to match the goals.

- Representativeness -Do the data accurately reflect actual site conditions, sampling procedures, and analytical method? QA/QC shall ensure this.

- Comparability - Is the report self-consistent in format, units, and standardization of methods used to generate it? QA/QC shall ensure this.

Additionally, statistical methods outlined in the QA/QC program have been applicable to data evaluation.

The Laboratory Supervisor and the Laboratory QA/QC Officer have been responsible for the evaluation of the above criteria and for enforcement of analytical protocols that

will necessarily lead to acceptable data quality. The signature of the Supervisor and QA/QC Officer accompany each laboratory analytical report and serve to ensure the overall validity of the reported data.

G.2.5 SAMPLE PLAN/LOG

Normal protocol demands client-and /or site-specific logging of all sample batches delivered to WESTON. Basic information -- such as client name, address, etc.; client phone number; reporting/invoicing instructions; site descriptions; and parameter-specifications and total requirements -- is initiated here. Additionally, sample storage/disposal instructions as well as turnaround requirements and sample collection requirements are addressed at this point.

The appropriate number of method blanks is also logged at this point, and in-house chain-of-custody documentation is initiated here.

G.2.6 SAMPLE RESULTS

WESTON's analytical protocols generally require five-point calibration curve <u>plus</u> a reagent blank s the basis for quantification analytes from a linear calibration curve. (A three-point plus blank curve vs. the original five point one is acceptable if it falls within the QA/QC requirements of $\pm$ 3 standard deviation of the original curve.) Linear regression analysis is then performed. Method- and detection limit-specific data are accessed for quantitation and report-writing from each such data set. For reporting accuracy, the algorithm

$$\frac{\text{Linear-Regressed Raw Concentration from Calibration Curve} \quad \text{Solid Sample Extract Volume If Solid} \quad \text{Concentration or Dilution Factor}}{\text{Solid Sample Mass If Solid} \quad \text{Fraction Solids If Solid}} = \text{Final Concentration}$$

is used for all quantitations. (All such algorithm input data are archived for long-term storage.) Detection limits for solids are generated on a per-sample basis and calculated by replacing "LINEAR-REGRESSED RAW CONCENTRATION FROM CALIBRATION CURVE" with "DETECTION LIMIT OF ANALYTE IN LIQUID MATRIX" in the above equation.

WESTON

G.2.7 CHAIN-OF-CUSTODY

Since they document the history of samples, chain-of-custody procedures are a crucial part of a sampling/analysis program. Chain-of-custody documentation enables identification and tracking of a sample from collection to analysis to reporting.

WESTON's chain-of-custody program necessitates the use of EPA-approved sample labels, secure custody, and attendant recordkeeping. Depending on the client's requirements, WESTON also offers container sealing during unattended transportation of samples.

In essence, WESTON considers a sample in custody if it: is in a WESTON employee's physical possession; it is in view of that WESTON employee; is secured by that WESTON employee to prevent tampering; or is secured by that WESTON employee in an area that is restricted to authorized personnel.

Each time a sample is relinquished from one analyst to another or from one major location to another, WESTON's analytical personnel are required to make appropriate entries. Personnel-specific initials are used as identifiers of analysts, as are location codes for various locations (refrigerators, extraction areas, analytical areas, etc.) within the laboratory. Each transaction for each sample is accompanied by a specific reason for transfer. Chain-of-custody documentation is given in Appendix H.

G.2.8 QA/QC OFFICER

Toward maintenance of a rigid, credible QA/QC regimen, WESTON Analytical Services maintains a full-time, in-house QA/QC officer who retains independent authority to declare out-of-control situations, thereby precluding reporting of unacceptable data. The QA/QC officer has been available, as needed, on the project.

WESTON

3. Total Organic Carbon (TOC)
4. Oil and Grease
5. Safe Drinking Water and Trace Metals

All required sample containers were prepared by WESTON laboratories in accordance with standard EPA procedures and protocols.

After the wells were purged, sampling consisted of the following steps:

1. Each sample container was gently filled from the pump line taking care to avoid aeration and turbulence in the sample water. All samples taken during this sampling were single phase (water).

2. Appropriate containers were filled according to analytical parameter. The containers used were:

   - Oil and Grease--1 liter amber glass bottles preserved with sulfuric acid
   - Phenol--1 liter amber glass bottles preserved with phosphoric acid and copper sulfate.
   - TOC--250 ml amber glass bottles with crimping septum seals, and preserved with hydrochloric acid.
   - Metals - 500 ml plastic bottles preserved with hydrochloric acid.
   - VOC - 40 ml clear glass bottles with septum top.

3. Grab samples were taken for immediate analyses in the field for pH, temperature and specific conductance.

4. The sample containers were wrapped in packaging material and placed in thermal chests packed with enough ice to ensure cooling to $4^{O}C$.

APPENDIX H

Sample Chain-of-Custody Documentation

CLIENT Griffiss AFB PRIORITY/HAZARD

WO#/PO# 0628-05-41 SUBMITTED BY J. Williams.

DATE RECEIVED MISC:

RFW#	SAMPLE DESCRIPTION	DATE COLLECTED	1L Amber Glass PA	1 L Amber Glass PA	250 ML Amber Glass PA	ML Clear Glass PA	500 ML Plastic HCl PA	PA	PA
1.	MW-B1A LANDFILL 7	8-15-84	O+G	Pheny	TOC	VOC	SOL. METAL		
2.	MW-1	8-15-84	✓	✓	✓	✓	✓		
3.	MW-2	8-15-84	✓	✓	✓	✓	✓		
4.	MW-2A	8-15-84	✓	✓	✓	✓	✓		
5.	MW 3	8-15-84	✓	✓	✓	✓	✓		
6.	MW 4	8-15-84	✓	✓	✓	✓	✓		
7.	[redacted] LF-EX	8-17-84	✓	✓	✓	✓	✓		
8.	SEEP	8-17-84	✓	✓	✓	✓	A+B ✓		
9.	NOTE: Soluble metals are:								
10.	As, Cd, Pb, Hg, Cr, Ni, Ag, Cu								
11.									
12.									
13.									
14.									
15.									
16.									
17.									
18.									
19.									
20.									
21.									
22.									
23.									
24.									
25.									

CHAIN OF CUSTODY

1. RFW # ______________________________

2. No. of bottles on this sheet:
   - 40 ml ______
   - 100 ml ______
   - 250 ml ______
   - 500 ml ______
   - 1000 ml ______
   - Total ______

3. Sampled by: ______________________________

4. Samples preserved and prepared according to S.O.P.: ______________ Initials

Relinquished	Received by	Time	Date	Reason for Change of Custody
	JC Oleeman	9:53	8/20/84	storage/analysis

COMMENTS: ______________________________

CLIENT Griffiss AFB

PRIORITY/HAZARD

WO#/PO# 0628-05-41

SUBMITTED BY J. Williams

DATE RECEIVED

MISC:

RFW#	SAMPLE DESCRIPTION		DATE COLLECTED	1 L. Amber Glass PA	250 mL Amber Glass PA	250 mL Plastic PA	PA	PA	PA	PA
1.	MW-A2	Tank Farm	8-16-84	✓ Org	TOC	✓ Sol. Pb ✓				
2.	MW-B1		8-16-84	✓	✓	✓				
3.	MW-B2A		8-17-84	✓	✓	✓				
4.	MW-F1		8-16-84	✓	✓	✓				
5.	MW-F1A		8-16-84	✓	✓	✓				
6.	MW-L1		8-17-84	✓	✓	✓				
7.	MW-17		8-17-84	✓	✓	✓				
8.	MW-19		8-1~~6~~-84	✓	✓	✓				
9.	MW-29		8-16-84	✓	✓	✓				
10.	MW-33	~~[illegible]~~	8-16-84	✓	✓	✓				
11.	MW-34	Bldg 210	8-17-84	✓	✓	✓				
12.	MW39		8-17-84	✓	✓	✓				
13.	MW-39A		8-17-84	✓	✓	✓				
14.	MW-EX									
15.										
16.										
17.										
18.										
19.										
20.										
21.										
22.										
23.										
24.										
25.										

CHAIN OF CUSTODY

1. RFW # ______________________________

2. No. of bottles on this sheet:
   40 ml ______
   100 ml ______
   250 ml ______
   500 ml ______
   1000 ml ______
   Total ______

3. Sampled by: ______________________________

4. Samples preserved and prepared according to S.O.P.: ______________
   Initials

Relinquished	Received by	Time	Date	Reason for Change of Custody
	J C Deemer	9:53 am	8/20/89	Storage/Analysis

COMMENTS: ______________________________

CLIENT Griffiss AFB

PRIORITY/HAZARD

WO#/PO# 0628-05-41

SUBMITTED BY J. Williams.

DATE RECEIVED

MISC: 1L Amber Glass / 1 L. Amber Glass / 250 mL Amber Glass / 40 mL Clear Glass / 500 mL Plastic / HCl

RFW#	SAMPLE DESCRIPTION	DATE COLLECTED	1L Amber Glass PA	1 L. Amber Glass PA	250 mL Amber Glass PA	40 mL Clear Glass PA	500 mL Plastic PA	PA	PA
1.	MW-B1A LANDFILL 7	8-15-84	O+G	Pheny	TOC	VOC	SOL. METAL		
2.	MW-1	8-15-84	✓	✓	✓	✓	✓		
3.	MW-2	8-15-84	✓	✓	✓	✓	✓		
4.	MW-2A	8-15-84	✓	✓	✓	✓	✓		
5.	MW 3	8-15-84	✓	✓	✓	✓	✓		
6.	MW 4	8-15-84	✓	✓	✓	✓	✓		
7.	[redacted] LF-EX	8-17-84	✓	✓	✓	✓	✓		
8.	SEEP	8-17-84	✓	✓	✓	✓	A+B		
9.	NOTE: Soluble Metals are:								
10.	As, Cd, Pb, Hg, Cr, Ni, Ag, Cu								
11.									
12.									
13.									
14.									
15.									
16.									
17.									
18.									
19.									
20.									
21.									
22.									
23.									
24.									
25.									

APPENDIX I

Standard Laboratory Analytical Protocols

Appendix I

Analytical Methods and Required Detection Limits

	Analyte	Detection Limit	Method
o	Volatile Organic Compounds (VOC)	Specified by compound in method	EPA Methods 601 and 602
o	Total Organic Carbon (TOC)	1 mg/L	EPA Method 415.1
o	Oils and Greases	0.1 mg/L	EPA Method 413.2
o	Phenol (total)	1 ug/L	EPA Method 420.1
o	Arsenic (As)	10 ug/L	EPA Method 206.2 or 206.3
o	Cadmium (Cd)	10 ug/L	EPA Method 213.2
o	Lead (Pb)	20 ug/L	EPA Method 239.2
o	Mercury (Hg)	1 ug/L	EPA Method 245.1
o	Chromium (Cr)	50 ug/L	EPA Method 218.1
o	Nickel (Ni)	100 ug/L	EPA Method 249.1
o	Silver (Ag)	10 ug/L	EPA Method 272.2
o	Copper (Cu)	20 ug/L	EPA Method 220.1

Oil and Grease

Scope:

The method is applicable to the determination of oil and grease in water.

Safety Precautions

Observe all standard laboratory safety procedures.

Principle

Oil and grease is extracted from water by intimate contact with 1,1,2-trichloro-1,2,2-trifluoroethane.

Interference

Trichlorotrifluoroethane has the ability to dissolve not only oil and grease but also other organic substances.

Sensitivity, Precision and Accuracy

The precision and accuracy have not been determined.

Apparatus

1. Infrared spectrophotometer, double beam, recording.

2. Cells, near-infrared silica.

3. Separatory funnel, 2 liter, with TFE stopcock.

4. Rotor evaporator and heating baths.

5. Grease-free cotton. (Glass wool)

Reagents

1. Hydrochloric acid, HCL, concentrate.

2. Granular sodium sulphate.

3. 1,1,2-trichloro-1,2,2-trifluoroethane.

Procedure

1. Acidify to pH 2.0. Add 2 or 3 drops concentrate HCL.

2. Transfer sample to a separatory funnel.

3. Rinse sample bottle with 100 ml of freon and add solvent washings to separatory funnel and extract.

4. Extract twice more with two 100 ml portions. Filter freon extracts through 25 grams NA_2SO_4.

5. Rotovap combined extracts to 5 ml.

6. Transfer to a 10 ml volumetric and bring to volume.

7. For quantitation, use an infrared spectrophotometer.

8. Calculations:

$$\text{Oil/grease in ug/ml} = \left(\frac{ug}{ml}\right) \times \frac{10\ ml}{1000\ ml}$$

Where 1) $\frac{ug}{ml}$ is obtained from the oil/grease IR standard.

2) $ppm = \frac{ug}{g}$ or $\frac{mg}{kg}$ or $\frac{ug}{ml}$ or $\frac{mg}{l}$

Reference: Methods For The Examination Of Water and Wastewater, 15th Edition, 1980.

Oil and Grease

Scope:

The method is applicable to the determination of oil and grease in soil and sludges.

Safety Precautions

Observe all standard laboratory safety procedures.

Principle

Oil and grease is extracted from soil by intimate contact with 1,1,2 - trichloro - 1,2,2 - trifluoroethane.

Interference

Trichlorotrifluorcethane has the ability to dissolve not only oil and grease but also other organic substances.

Sensitivity, Precision and Accuracy

The precision and accuracy have not been determined.

Apparatus

1. Infrared spectrophotometer, double beam, recording.
2. Cells, near-infrared silica.
3. Extraction apparatus, Soxhlet.
4. Extraction thimble, paper.
5. Rotor evaporator and heating baths.
6. Grease-free cotton. (glass wool)

Reagents

1. Hydrochloric acid, HCl, concentrate.
2. Magnesium sulfate monohydrate.
3. 1,1,2 - Trichloro - 1,2,2 - trifluorcethane.

Procedure

1. Weigh out 20 $\pm$ 0.5 g of sample in a 150 mL beaker.
2. Acidify to pH 2.0. Add 2 or 3 drops 50% H_2SO_4.

3. Add 20g, Mg $SO_4 \cdot H_2O$ and mix uniformly.

4. Transfer to a paper extraction thimble (size 33 x 94) and place glass wool plug in top of thimble.

5. Extract in a Soxhlet apparatus, using 150 mL trichlorotrifluoroethane, at a rate of 20 cycles/hr. for 3 hours.

6. Turn off heat to Soxhlet apparatus, take off condensor, and let trichlorofluoroethane evaporate until sample extract and volume around extraction thimble is less than 100 mL.

   Pour sample extract from boiling flask through glass wool into a 100 mL clean volumetric flask.

   a) Use trichlorofluoroethane Soxhlet extractor to rinse boiling flask. (Because of low boiling point of trichlorofluoroethane compared to O&G, roto evaporator is not necessary.)

   b) The glass wool removes water and/or solid Mg SO_4/sample that may end up in trichlorofluoroethane extract.

7. For quantitation use an infrared spectrophotometer.

8. Calculations:

$$\text{oil/grease in } \mu g/g = \left(\frac{\mu g}{mL}\right) \times \frac{100 \text{ mL}}{\text{g of sample used}}$$

where:

1) $\frac{\mu g}{mL}$ is obtained from the oil/grease IR standard curve

2) $ppm = \frac{\mu g}{g}$ or $\frac{mg}{kg}$ or $\frac{\mu g}{mL}$ or $\frac{mg}{L}$

Reference: Methods for the Examination of Water and Waste Water, 15th Edition, 1980.

Appendix J

Federal and State Drinking Water and Human Health Standards Applicable in New York

GUIDE TO GROUND-WATER STANDARDS OF THE UNITED STATES

API PUBLICATION 4366

JULY 1983

Prepared by
Ecological Analysts, Inc.
15 Loveton Circle
Sparks, Maryland 21152

3. *FEDERAL PROTECTION OF GROUND-WATER QUALITY*

The federal programs dealing with the protection of ground-water quality are administered largely by the Environmental Protection Agency (EPA). The federal programs which provide the framework for state regulations are summarized in this section.

3.1 GROUND-WATER PROTECTION POLICY

At this writing, February 1983, U.S. EPA's final policy on ground-water protection, scheduled for September 1982 release, has not been published. Based on the proposed strategy published by EPA in November 1980 and recent press releases, it appears that EPA will be implementing a policy that would give the states lead responsibility in the protection of ground-water quality. EPA's efforts apparently will be focused in three major areas:

1. Development of an internally consistent federal approach to ground-water protection
2. Monitoring, research and development efforts directed toward more comprehensive problem definition and new detection, controls, and clean-up technology development
3. Guidance, coordination, and assistance to states in the development of state policies

A significant component of EPA's policy is expected to be a ground-water classification system which could be used to determine the degree of protection needed for various types of ground water. Ground-water classification is discussed in Chapter 4.

3.2 CLEAN WATER ACT

This statute refers to ground-water protection in municipal waste water treatment, planning, and research programs. Its principal regulatory programs, however, focus on surface water. Section 303 empowers EPA to approve states' water quality standards which are based on the states' classification of rivers and streams. Many states have included ground water in their definition of "waters of the state" for purposes of this act (state summaries). On this basis the National (state) Pollutant Discharge Elimination System (NPDES/SPDES) permitting process may be invocable for purposes of ground-water protection. In addition the act empowers EPA to

1. Develop a comprehensive program for ground-water pollution control [Section 102(a)]
2. In cooperation with states, equip and maintain a surveillance system for monitoring ground-water quality [Section 104(a)(5)]
3. Provide grants to states and area-wide agencies to develop ground-water quality management plans to identify salt water intrusion and control disposal of pollutants in subsurface excavations, and control disposition of wastes. (May include authority for comprehensive ground-water management plans, including conjunctive use with surface water) [Section 102(c), 208(b)]
4. Require development of Best Management Practices (BMP) to control nonpoint source pollution problems to ground-water quality [Section 208(b)]
5. Develop criteria for ground-water quality considering kind and extent of effects on health and welfare from the presence of pollutants [Section 304(a)]
6. Determine information necessary to restore and maintain chemical, physical, and biological integrity of ground water [Section 304(a)]
7. Issue information on the factors necessary to restore and maintain chemical, physical, and biological integrity of ground water [Sections 304(a)(2)]

3.3 SAFE DRINKING WATER ACT

This statute authorizes EPA to set maximum contaminant levels (MCLs) and monitoring requirements for public water systems and provides for the protection of underground sources of drinking water. The MCLs regulate the quality of "finished" water, i.e., water as delivered, not the quality of the source water. As discussed below, the MCLs have been utilized by EPA and the states as the basis for other regulations dealing with ground-water quality and protection.

3.3.1 National Interim Primary Drinking Water Regulations

EPA initiated a detailed study of the health effects of various contaminants in water soon after the Safe Drinking Act (SDWA) was signed into law. So that the regulations could include the findings of this and other stuzes, the primary drinking water regulations were to be developed in two stages: an interim version and a final verson. The interim version of the regulation became effective 24 June 1977. SDWA provides for delegation of authority to the states. State Primary Drinking Water Regulations must be at least as stringent as the federal regulations.

The National Interim Primary Drinking Water Regulations define Maximum Contaminant Level as the maximum permissible level of a contaminant in water which is delivered to the free-flowing outlet of the ultimate user of a public water system, except in the case of turbidity (applicable to surface water only) where the maximum permissible level is measured at the point of entry to the distribution system. The MCLs are provided with the state summaries.

3.3.2 National Secondary Drinking Water Regulations

These regulations control contaminants in drinking water that primarily affect the aesthetic qualities relating to the public acceptance of drinking water. At considerably higher concentrations of these contaminants health implications may also exist as well as aesthetic degradation. The National Secondary Drinking Water Regulations are not federally enforceable but are intended as guidelines for the states.

Secondary Maximum Contaminant Levels (SMCLs) are defined as the maximum permissible level of a contaminant in water which is delivered to the free-flowing outlet of the ultimate user of a public water system. Federal and state SMCLs are provided in the state summaries. The states may establish higher or lower levels which may be appropriate depending upon local conditions such as unavailability of alternate sources of water or other compelling factors, provided the public health and welfare are not adversely affected.

3.3.3 Sole Source Aquifer

The Sole Source Aquifer provisions of SDWA allow EPA to designate an aquifer as the sole source of drinking water for an area thereby guaranteeing protection from contamination by federally assisted activities. Local, regional, or state agencies can petition EPA for sole source designation. The EPA Administrator may designate an aquifer which is a sole or principal drinking water source if its contamination would create a significant hazard to public health. If the designation is made, no federal money or financial commitment may be made for any project which the Administrator determines may contaminate the designated aquifer through its recharge zone.

At this writing, February 1983, EPA has designated the following ten sole source aquifers:

Biscayne Aquifer - Florida
Buried Valley Aquifer - New Jersey
Edwards Aquifer - Texas
Camano Island—Whidbey Island Aquifer - Washington
Spokane-Rathdrum Aquifer - Washington and Idaho
Nassau and Suffolk counties - New York
Cape Cod - Massachusetts
Fresno - California
Ten Mile Creek - Maryland
Northern Guam Lens - Guam

The following eighteen are under consideration:

Arizona
- Santa Cruz, Upper Santa Cruz, Aura-Altar Basins

California
- Scotts Valley

Delaware
- New Castle County

Florida
- Volusia - Floridan Aquifer

Idaho
- Snake River Plain

Louisiana
- Baton Rouge
- DeSota Parish

New Jersey
- Coastal Plain
- Ridgewood
- Upper Rockaway

New York
- Kings and Queens counties
- Sardinia
- Schenectady
- Vestal

Pennsylvania
- Seven Valleys

Texas
- Carrizo-Wilcox Aquifer

Texas and New Mexico
- Delaware Basin

Wisconsin
- Niagara Aquifer

3.6 RESOURCE CONSERVATION AND RECOVERY ACT

The Solid Waste Disposal Act and the Resource Recovery Act of 1970, as amended by the Resource Conservation and Recovery Act of 1976 (RCRA), require EPA to establish a national program to regulate the management of waste materials.

3.6.1 Solid Waste

Subtitle D of RCRA established a broad-based national program to improve solid waste management through the development of state and regional solid waste management plans. The act offered federal financial assistance to states interested in developing and implementing a solid waste management plan. The state plans, under federal guidelines, identify respective responsibilities of local, state, and regional authorities, and encourage resource recovery and conservations and the application and enforcement of environmentally sound disposal practices.

A major element of the Subtitle D program is the open dump inventory. Section 4005 of RCRA prohibits open dumping. Federal criteria for classifying solid waste management facilities are provided in 40 CFR 257. EPA cannot approve a state solid waste management program with less stringent criteria. Solid waste management facilities failing to satisfy the criteria are considered open dumps. In order to satisfy these criteria, a facility or practice (in addition to other environmental considerations) shall not contaminate an underground drinking water source beyond the solid waste boundary or beyond an alternative boundary established by the state or in court persuant to the stipulations of 40 CFR 257.3-4. The federal criteria define contamination as an exceedence of the MCLs provided in the National Interim Primary Drinking Water Regulations or an increase in concentration of any parameter for which the ambient concentration exceed the MCL.

3.6.2 Hazardous Waste

EPA has issued a series of hazardous waste regulations under Subtitle C of RCRA (40 CFR 260 to 267 and 122 to 124). On 19 May 1980, EPA issued a comprehensive set of standards for generators and transporters of hazardous waste and "interim status" standards for facilities in existence on 19 November 1980, that treat, store, or dispose of hazardous waste. Such facilities were allowed to operate under interim status until they received an RCRA permit. Subsequently, EPA issued standards for granting RCRA permits to treatment and storage facilities. Standards for land disposal facilities were issued on 26 July 1982—virtually completing the program for controlling hazardous waste under RCRA.

The standards for permitting land disposal facilities were issued after a wide range of regulatory options were considered. Over a period of several years, EPA proposed two different sets of land disposal standards and solicited comments on various issues. On 13 February 1981, EPA issued temporary standards for new land disposal facilities. The 26 July regulations replace those temporary standards except for Class I underground injection wells. These will remain subject to the temporary standards until final standards are issued.

The regulations consist primarily of two complementary sets of performance standards:

1. A set of design and operating standards tailored to each of four types of facilities
2. Ground-water monitoring and response regulations applicable to all land disposal facilities

The design and operating standards implement a liquids management strategy that has two goals:

1. Minimize leachate generated at the facility
2. Remove leachate generated to minimize its chance of reaching ground water

The major requirements include

1. Liner
   - Requirement: design to prevent migration of waste out of the facility during its active life
   - Applicability: landfills, surface impoundments, and waste piles
2. Leachate collection and removal
   - Requirement: collect and remove leachate from the facility and ensure that leachate depth over the liner does not exceed 30 centimeters (1 foot)
   - Applicability: landfills and waste piles

3. Run-on and runoff control systems
   - Requirement: design to control flow during at least 25-year storm
   - Applicability: landfills, waste piles, land treatment
4. Wind dispersal controls
   - Requirement: cover waste or otherwise manage unit to control wind dispersal
   - Applicability: landfills, waste piles, and land treatment units that contain particulate matter
5. Overtopping controls
   - Requirement: prevent overtopping or overfilling
   - Applicability: surface impoundments
6. Disposal unit closure
   - Requirement: final cover (cap) over waste unit designed to minimize infiltration of precipitation
   - Applicability: landfills and surface impoundments (if used for disposal)
7. Storage unit closure
   - Requirement: remove waste and decontaminate
   - Applicability: surface impoundments used for treatment or storage and waste piles
8. Postclosure Care
   - Maintain effectiveness of final cover
   - Operate leachate collection and removal system
   - Maintain ground-water monitoring system (and leak detection system where double liner is used)
   - Continue 30 years after closure

The goal of the ground-water monitoring and response program is to detect and correct any ground-water contamination. There are four main elements:

1. A detection monitoring program which requires the permittee to install a system to monitor ground water in the uppermost aquifer to determine if a leachate plume has reached the edge of the waste management area.
2. A ground-water protection standard is set when a hazardous constituent is detected. The standard specifies concentration limits, compliance point, and compliance period.
3. A compliance monitoring program determines if the facility is complying with its ground-water protection standard.
4. Corrective action is required when the ground-water protection standard is violated. The permittee must either remove the contamination or treat it in place to restore ground-water quality.

Until hazardous waste management facilities are issued permits, existing facilities will continue to operate under interim status standards. Facilities operating under interim status will be required to file Part B applications for final permits.

Under Subtitle C of RCRA, EPA approves state hazardous waste management programs in two phases. Phase I authorization gives states the right to control transportation and generation of hazardous wastes within their borders and to regulate existing treatment, storage, and disposal facilities. Phase II authorization includes the permitting of new facilities.

3.7 COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT

This statute (CERCLA), commonly referred to as Superfund, authorizes EPA to respond to releases or threatened releases into the environment, including ground water, of any hazardous substance which may present an imminent and substantial danger to public health. The act provides funds for emergency action and has cost recovery provisions.

3.3.4 Underground Injection Control

The Underground Injection Control (UIC) program regulates the uses of underground injection wells to protect an underground source of drinking water (USDW). USDW means an aquifer or its portion which

1. supplies any public water system or contains a sufficient quantity of ground water to supply a public water system;
2. currently supplies drinking water for human consumption or contains less than 10,000 mg/liter total dissolved solids; and
3. is not an exempted aquifer (40 CFR 146.04 provides criteria for exemption).

SDWA requires any state designated by EPA as requiring a UIC program to develop and submit a state UIC program for EPA approval. EPA has designated each of the fifty states.

The federal program classifies injection wells as follows:

Class I—Wells used to inject hazardous waste, or other industrial and municipal disposal wells which inject fluids beneath the lower-most formation containing a USDW within one-quarter mile of the well bore.

Class II—Wells that inject fluids

1. which are brought to the surface as part of conventional oil or natural gas production and may be mixed with production waste waters from gas plants, unless those waters are classified as a hazardous waste at the time of injection;
2. for enhanced recovery of oil or natural gas; and
3. for storage of hydrocarbons which are liquid at standard temperature and pressure.

Class III—Wells that inject for extraction of minerals including

1. mining of sulfur by the Frasch process;
2. in situ production of uranium or other metals. This category includes only in situ production from ore bodies which have not been conventionally mined. Solution mining of conventional mines such as stopes leaching is included in Class V; and
3. solution mining of salts or potash.

Class IV—Wells used to dispose of hazardous or radioactive waste into or above a formation which contains a USDW within one-quarter mile of the well. Also, wells used to inject hazardous waste that cannot be classified as Class I or Class IV under the above criteria are Class IV wells.

Class V—All other injection wells (40 CFR 146.05(e) and 146.51 provide specific information and exemptions).

Underground injection is controlled through the permitting process. Construction, operation, monitoring and reporting activities are controlled. Individual state programs are based upon, and must be essentially equivalent to, the federal criteria and standards (40 CFR 146).

3.4 TOXIC SUBSTANCE CONTROL ACT

This statute (TSCA) authorizes EPA to restrict or prohibit the manufacture, distribution, and use of products which may result in unreasonable risk to health and the environment. Although ground water is not specifically named in the Act, EPA has taken the position that the protection of health and the environment includes the protection of ground water.

3.5 FEDERAL INSECTICIDE, FUNGICIDE, RODENTICIDE ACT

This statute (FIFRA) gives EPA the responsibility to control the sale and use of all pesticides to prevent unreasonable adverse environmental and health effects. The use and disposal of pesticide packages and containers is also regulated. In deciding whether to register, cancel, suspend, or change the classification of a pesticide, EPA considers a broad range of environmental impacts including those affecting ground water.

NEW YORK

Classification–Ground water is included in the definition of "Waters of the State" as found in the New York Environmental Conservation Law. A classification system has been adopted with three ground-water classes.

Class GA–The best usage of Class GA waters is as a source of potable water supply. Class GA waters are fresh ground waters found in the saturated zone of unconsolidated deposits and consolidated rock or bed rock.

Class GSA–The best usage of Class GSA waters is as a source of potable mineral waters, for conversion to fresh potable waters, or as raw material for the manufacture of sodium chloride, its derivatives, or similar products. Such waters are saline waters found in the saturated zone.

Class GSB–The best usage of Class GSB waters is as a receiving water for disposal of wastes. Such waters are those saline waters found in the saturated zone which have a chloride concentration in excess of 1,000 mg/liter, or a total dissolved solids concentration in excess of 2,000 mg/liter.

Quality Standards–Numerical and narrative quality standards have been developed for Class GA, while narrative standards are applied to Class GSA and GSB. The waters of all classes shall be free from all sewage, industrial waste or other wastes, taste- or odor-producing substances, toxic pollutants, thermal discharges, radioactive substances or other deleterious matter which may impair the quality of the ground water for its designated use.

Drinking Water Standards–The New York Department of Health has adopted the federal primary and secondary drinking water standards.

Appropriation–The reasonable use system governs ground water allocations in New York. All users are entitled to ground-water use without permit requirements or restrictions, except on Long Island.

Controlled Use Areas–The Department of Environmental Conservation requires a permit from all users, except agriculture, of greater than 45 gallons per minute on Long Island.

Well Construction–All well drillers must be licensed by the Department of Health and follow construction standards.

Underground Injection Control–New York does not intend to take over the federal UIC program, which will be administered by EPA Region 2. Underground injection is regulated by the New York SPDES permit program.

Waste Management Facilities–The solid and hazardous waste management programs are administered by the Department of Environmental Conservation.

Solid Waste–The New York Solid Waste Management Regulations require a ground-water monitoring system at all disposal sites, with quarterly and annual monitoring required. Sampling parameters are determined on a case-by-case basis. In addition, leachate and discharges from disposal sites shall not cause the ground-water quality standards to be contravened.

Hazardous Waste–New York has received interim status authority for its RCRA Phase I program and is seeking Phase II authority. Ground-water monitoring requirements have been established that are identical to RCRA requirements (40 CFR 265, F).

Sole Source Aquifers–Nassau and Suffolk counties have been designated as a sole source aquifer. In addition, Kings County, Queens County, and the towns of Sardinia, Vestal, and Schenectady have petitioned for sole source designation.

Geological Surveys–

Geological Survey
State Museum and Science Service
State Education Department
Cultural Education Center
Empire State Plaza
Albany, NY 12234
518-474-5816
State Geologist:
Dr. Robert Fakundiny

Water Resources Division
U.S. Geological Survey
P.O. Box 1350
Albany, NY 12201
518-472-3107
District Chief:
L.A. Martens

References–
New York Environmental Conservation Law
(N.Y.E.C.L., Article 17, 37, and 71)

New York Water Classifications and Quality Standards
(Official Codes, Rules and Regulations, Ch. X, Article 2, Parts 700–704).

New York Solid Waste Management Facilities Rules
(N.Y. Rules and Regulations, Title 6, Ch. 360 and Part 8)

Contacts–
Mr. Daniel M. Darolo
Director, Division of Water
Department of Environmental Conservation
50 Wolf Road
Albany, NY 12233

Approved by the Division of Water in a letter received March 1983.

NEW YORK

Parameter (mg/l unless noted)	Drinking Water Standards Federal	Drinking Water Standards State	Quality Standards Class GA	Monitoring Requirements Solid Waste	Monitoring Requirements Hazardous Waste
Benzo(a) pyrene			*		
Kepone			*		
PCB			0.0001		
ETU			*		
Chloroform			0.1		
CCl_4			0.005		
PCNB			*		
Trichloroethylene			0.010		
Diphenylhydrazine			*		
bis (2-chloroethyl ether)			0.001		
2,4,5-T			0.035		
TCDD			3.5×10^{-8}		
MCPA			0.00044		
Amiben			0.0875		
Dicamba			0.00044		
Alachlor			0.035		
Butachlor			0.0035		
Propachlor			0.035		
Propanil			0.007		
Aldicarb			0.00035		
Bromacil			0.0044		
Paraquat			0.00298		
Trifluralin			0.035		
Nitralin			0.035		
Benefin			0.035		
Guthion			0.0044		
Diazinon			0.0007		
Phorate			*		
Carbaryl			0.0287		
Ziram			0.00418		
Ferbam			0.0418		
Captan			0.0175		
Folpet			0.056		
HCB			0.00035		
PDB			0.0047		
Parathion			0.0015		
Malathion			0.007		
Maneb			0.00175		
Zineb			0.00175		
Dithane			0.00175		
Thiram			0.00175		
Atrazine			0.0075		
Propazine			0.016		
Simazine			0.07525		
di-n-butylphthalate			0.770		
DEHP			4.2		
Hexachlorophene			0.007		
Methyl methacrylate			0.7		
PCP			0.021		
Styrene			0.931		

Note: "M" denotes monitoring requirement. See Section 4.3.
(*) not detectable.

ENVIRONMENTAL PROTECTION AGENCY NATIONAL INTERIM PRIMARY DRINKING WATER REGULATIONS

(40 CFR 141; 40 FR 59565, December 24, 1975; Amended by 41 FR 28402, July 9, 1976; 44 FR 68641, November 29, 1979; Corrected by 45 FR 15542, March 11, 1980; 45 FR 57342, August 27, 1980)

Title 40—Protection of Environment
CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER D—WATER PROGRAMS

PART 141—NATIONAL INTERIM PRIMARY DRINKING WATER REGULATIONS

Authority: Secs. 1412, 1414, 1445, and 1450 of the Public Health Service Act, 88 Stat. 1660 (42 U.S.C. 300g-1, 300g-3, 300j-4, and 300j-9).

Subpart A—General

§ 141.1 Applicability.

This part establishes primary drinking water regulations pursuant to section 1412 of the Public Health Service Act, as amended by the Safe Drinking Water Act (Pub. L. 93-523); and related regulations applicable to public water systems.

§ 141.2 Definitions.

As used in this part, the term:

(a) "Act" means the Public Health Service Act, as amended by the Safe Drinking Water Act, Pub. L. 93-523.

(b) "Contaminant" means any physical, chemical, biological, or radiological substance or matter in water.

(c) "Maximum contaminant level" means the maximum permissible level of a contaminant in water which is delivered to the free flowing outlet of the ultimate user of a public water system, except in the case of turbidity where the maximum permissible level is measured at the point of entry to the distribution system. Contaminants added to the water under circumstances controlled by the user, except those resulting from corrosion of piping and plumbing caused by water quality, are excluded from this definition.

(d) "Person" means an individual, corporation, company, association, partnership, State, municipality, or Federal agency.

(e) "Public water system" means a system for the provision to the public of piped water for human consumption, if such system has at least fifteen service connections or regularly serves an average of at least twenty-five individuals daily at least 60 days out of the year. Such term includes (1) any collection, treatment, storage, and distribution facilities under control of the operator of such system and used primarily in connection with such system, and (2) any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system. A public water system is either a "community water system" or a non-community water system."

(f) "Community water system" means a public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

(g) "Non-community water system" means a public water system that is not a community water system.

(f) "Sanitary survey" means an on-site review of the water source, facilities, equipment, operation and maintenance of a public water system for the purpose of evaluating the adequacy of such source, facilities, equipment, operation and maintenance for producing and distributing safe drinking water.

(g) "Standard sample" means the aliquot of finished drinking water that is examined for the presence of coliform bacteria.

(h) "State" means the agency of the State government which has jurisdiction over public water systems. During any period when a State does not have primary enforcement responsibility pursuant to Section 1413 of the Act, the term "State" means the Regional Administrator, U.S. Environmental Protection Agency.

(i) "Supplier of water" means any person who owns or operates a public water system.

(j) "Dose equivalent" means the product of the absorbed dose from ionizing radiation and such factors as account for differences in biological effectiveness due to the type of radiation and its distribution in the body as specified by the International Commission on Radiological Units and Measurements (ICRU).

(k) "Rem" means the unit of dose equivalent from ionizing radiation to the total body or any internal organ or organ system. A "millirem (mrem)" is 1/1000 of a rem.

(l) "Picocurie (pCi)" means the quantity of radioactive material producing 2.22 nuclear transformations per minute.

(m) "Gross alpha particle activity" means the total radioactivity due to alpha particle emission as inferred from measurements on a dry sample.

(n) "Man-made beta particle and photon emitters" means all radionuclides emitting beta particles and/or

listed in Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure, NBS Handbook 69, except the daughter products of thorium-232, uranium-235 and uranium-238.

(o) "Gross beta particle activity" means the total radioactivity due to beta particle emission as inferred from measurements on a dry sample.

[41 FR 28402, July 9, 1976]
[141.2 (p)-(t) added by 44 FR 68641, November 29, 1979]

(p) "Halogen" means one of the chemical elements chlorine, bromine or iodine.

(q) "Trihalomethane" (THM) means one of the family of organic compounds, named as derivatives of methane, wherein three of the four hydrogen atoms in methane are each substituted by a halogen atom in the molecular structure.

(r) "Total trihalomethanes" (TTHM) means the sum of the concentration in milligrams per liter of the trihalomethane compounds [trichloromethane [chloroform], dibromochloromethane, bromodichloromethane and tribromomethane [bromoform]), rounded to two significant figures.

(s) "Maximum Total Trihalomethane Potential (MTP)" means the maximum concentration of total trihalomethanes produced in a given water containing a disinfectant residual after 7 days at a temperature of 25° C or above.

(t) "Disinfectant" means any oxidant, including but not limited to chlorine, chlorine dioxide, chloramines, and ozone added to water in any part of the treatment or distribution process, that is intended to kill or inactivate pathogenic microorganisms.

§ 141.3 Coverage.

This part shall apply to each public water system, unless the public water system meets all of the following conditions:

(a) Consists only of distribution and storage facilities (and does not have any collection and treatment facilities);

(b) Obtains all of its water from, but is not owned or operated by, a public water system to which such regulations apply;

(c) Does not sell water to any person; and

(d) Is not a carrier which conveys passengers in interstate commerce.

§ 141.4 Variances and exemptions.

Variances or exemptions from certain provisions of these regulations may be granted pursuant to Sections 1415 and 1416 of the Act by the entity with primary enforcement responsibility. Provisions under Part 142, *National Interim Primary Drinking Water Regulations Implementation*—subpart E (Variances) and subpart F (Exemptions)—apply where EPA has primary enforcement responsibility.

§ 141.5 Siting requirements.

Before a person may enter into a financial commitment for or initiate construction of a new public water system or increase the capacity of an existing public water system, he shall notify the State, and, to the extent practicable, avoid locating part or all of the new or expanded facility at a site which:

(a) Is subject to a significant risk from earthquakes, floods, fires or other disasters which could cause a breakdown of the public water system or a portion thereof; or

(b) Except for intake structures, is within the floodplain of a 100-year flood or is lower than any recorded high tide where appropriate records exist.

The U.S. Environmental Protection Agency will not seek to override land use decisions affecting public water systems siting which are made at the State or local government levels.

§ 141.6 Effective dates.

[141.6 revised by 44 FR 68641, November 29, 1979]

(a) Except as provided in paragraph (b) of this section, the regulations set forth in this part shall take effect on June 24, 1977.

(b) The regulations for total trihalomethanes set forth in § 141.12(c) shall take effect 2 years after the date of promulgation of these regulations for community water systems serving 75,000 or more individuals, and 4 years after the date of promulgation for communities serving 10,000 to 74,999 individuals.

(c) The regulations set forth in 141.11 (a), (c) and (d); 141.14(a)(1); 141.14(b)(1)(c); 141.14(b)(2)(i); 141.14(d); 141.21 (a), (c) and (i); 141.22 (a) and (e); 141.23 (a)(3) and (a)(4); 141.23(f); 141.24(a)(3); 141.24 (e) and (f); 141.25(e); 141.27(a); 141.28 (a) and (b); 141.31 (a), (c), (d) and (e); 141.32(b)(3); and 141.32(d) shall take effect immediately upon promulgation.

(d) The regulations set forth in 141.41 shall take effect 18 months from the date of promulgation. Suppliers must complete the first round of sampling and reporting within 12 months following the effective date.

(e) The regulations set forth in 141.42 shall take effect 18 months from the date of promulgation. All requirements in 141.42 must be completed within 12 months following the effective date.

[141.6 (c)-(e) added by 45 FR 57342, August 27, 1980]

Subpart B—Maximum Contaminant Levels

§ 141.11 Maximum contaminant levels for inorganic chemicals.

(a) The MCL for nitrate is applicable to both community water systems and non-community water systems except as provided by in paragraph (d). The levels for the other organic chemicals apply only to community water systems. Compliance with MCLs for inorganic chemicals is calculated pursuant to § 141.23.

[141.11(a) amended by 45 FR 57342, August 27, 1980]

(b) The following are the maximum contaminant levels for inorganic chemicals other than fluoride:

Contaminant	Level, milligrams per liter
Arsenic	0.05
Barium	1.
Cadmium	0.010
Chromium	0.05
Lead	0.05
Mercury	0.002
Nitrate (as N)	10.
Selenium	0.01
Silver	0.05

(c) When the annual average of the maximum daily air temperatures for the location in which the community water system is situated is the following, the maximum contaminant levels for fluoride are:

Temperature Degrees Fahrenheit	Degrees Celsius	Level, milligrams per liter
53.7 and below	12.0 and below	2.4
53.8 to 58.3	12.1 to 14.6	2.2
58.4 to 63.8	14.7 to 17.6	2.0
63.9 to 70.6	17.7 to 21.4	1.8
70.7 to 79.2	21.5 to 26.2	1.6
79.3 to 90.5	26.3 to 32.5	1.4

(c) Fluoride at optimum levels in drinking water has been shown to have beneficial effects in reducing the occurrence of tooth decay.

[141.11 (c) amended by 45 FR 57342, August 27, 1980]

(d) At the discretion of the State, nitrate levels not to exceed 20 mg/l may be allowed in a non-community water system if the supplier of water demonstrates to the satisfaction of the State that:

(1) Such water will not be available to children under 6 months of age; and

(2) There will be continuous posting of the fact that nitrate levels exceed 10 mg/l and the potential health effects of exposure; and

(3) Local and State public health authorities will be notified annually of nitrate levels that exceed 10 mg/l; and

(4) No adverse health effects shall result.

[141.11 (d) added by 45 FR 57342, August 27, 1980]

NATIONAL INTERIM PRIMARY DRINKING WATER REGULATIONS

Arsenic	0.05 mg/l
Barium	1.0 mg/l
Cadmium	0.010 mg/l
Chromium	0.05 mg/l
Lead	0.05 mg/l
Mercury	0.002 mg/l
Nitrate (as N)	10 mg/l
Selenium	0.01 mg/l
Silver	0.05 mg/l
Fluoride	1.4 - 2/4 mg/l (ambient temp)
Endrin	0.0002 mg/l
Lindane	0.004 mg/l
Methoxychlor	0.1 mg/l
Toxaphene	0.005 mg/l
2,4 - D	0.1 mg/l
2,4,5 - TP Silvex	0.01 mg/l
Coliform bacteria	< 1/100 ml
Radium - 226 + radium -228	5 pCi/l
Gross alpha particle activity	15 pCi/l
Beta particle and photon radioactivity	4 mrem (annual dose equivalent)
Turbidity	1 Tu (up to 5 Tu)
Trihalomethanes (the sum of the concentrations of bromodichloromethane, dibromochloromethane, tribromomethane (bromoform) and trichloromethane (chloroform))	0.10 mg/l

Sodium Monitoring and Reporting
Corrosion Monitoring and Distribution System Composition

NATIONAL SECONDARY DRINKING WATER REGULATIONS

Chloride	250 mg/l
Color	15 color units
Copper	1 mg/l
Corrosivity	Non-corrosive
Foaming Agents	0.5 mg/l
Iron	0.3 mg/l
Manganese	0.05 mg/l
Odor	3 threshold odor number
pH	6.5 - 8.5
Sulfate	250 mg/l
TDS	500 mg/l
Zinc	5 mg/l

Appendix K

Net Weight of Selected Analytes in Battery Acid Pits

WESTON DESIGNERS CONSULTANTS

BY DWJ DATE 10-4-84 DIV Geosciences SHEET 1 OF 1

CHKD BY RCJ DATE 10-5-85 DEPT W.O. NO.

PROJECT GRIFFISS AIR FORCE BASE

SUBJECT HEAVY METAL WEIGHT IN BATTERY ACID PITS

NET WEIGHT OF SELECTED ANALYTES IN BATTERY ACID PITS

			Pb		Cu		Zn	
Bldg. No.	Sample No.	Depth (ft)	Concen. (µg/g)	Net Wt. lbs	Concen. (µg/g)	Net Wt. (lbs)	Concen. (µg/g)	Net Wt. (lbs)
101	101-1	0-2	83,000	66.4	784	0.63	262	0.21
	101-2	2-4	1,170	0.94	30	0.02	9	0.01
	101-3	4-6	465	0.37	62	0.05	29	0.02
	101-4	6-8	53	0.04	42	0.03	12	0.06
			Total Pb =	67.75	Total Cu =	0.73		0.30
222	222-1	0-2	65,800	52.6	500	0.40	329	0.26
	222-2	2-4	861	0.68	16	0.01	85	0.07
	222-3	4-6	784	0.63	171	0.14	128	0.10
	222-4	6-8	638	0.51	9	0.01	29	0.02
	222-5	8-10	364	0.29	5	0.00	14	0.01
	222-6	10-12	107	0.08	11	0.01	20	0.02
			Total Pb =	54.79		0.57		0.48

Sample Calculation:

$$\underbrace{83{,}000 \frac{\mu g\ Pb}{g}}_{\text{SOIL ANALYTE CONCENTRATION}} \times \underbrace{8\ ft^3}_{\text{VOLUME OF 2-FT SAMPLE INTERVAL}} \times \underbrace{\frac{100\ lbs}{ft^3}}_{\text{ESTIMATED BULK DENSITY OF A SANDY SLUDGE}} \times \underbrace{\frac{1\ g}{10^6\ \mu g}}_{\text{CONVERSION FACTOR}} = 5.91\ lbs\ Pb$$

K-1